Advanced Microeconomics II (research track)

Christoph Schottmüller

July 11, 2018

1 News

- On July 11, we use the class for question hour. If you want to have an answer for sure, please send me your questions before July 9.

- Updated slides (lecture June 27): added an explanation at the end of the slides why ex ante budget balance is sufficient for ex post budget balance; changed almost efficient mechanism for many seller/buyer setting such that it is dominant strategy incentive compatible for finite m and n

- Exam date: July 18, 10:00-11:00 in 103 Seminarraum S56 (63 Sitzpl.) (103/EG/0.106)

2 Material

- Exercises: tex pdf

- Slides:

    - Dominance and rationalizability
    - Nash Theorem
    - correlated eq.
    - BNE
    - auctions
    - SPNE
    - PBE
    - signaling

- cheap talk
- revelation principle
- dominant strat. implementation
- Myerson Satterthwaite
- screening
- optimal auctions
- optimal trading mechanism and limit results, numerics
- correlated information
- information design
- buyer optimal learning

- Handouts etc.:

  - math handout
  - envelope theorem and monotonicity constraint

3 Prerequisites

I assume that you have some introductory knowledge of game theory on the level of Gibbons (1992). In particular, you should know the material in chapters 1 and 2 in Gibbons' book (strategic form games, dominance, mixed strategies, mixed and pure Nash equilibrium, extensive form games, game trees, backwards induction, subgame perfect Nash equilibrium) and be able to apply it in simple games. From Advanced Microeconomics I, we built upon the part about *decision making under uncertainty* (expected utility theorem). In terms of mathematics, it is helpful if you master the material of the course *Advanced Mathematics for Economists*. Having said that, most of the used math tools will not be far beyond high school maths. At the minimum you have to know (partial) differentiation, integration and optimization of functions and basic statistics (discrete and continuous probability distributions, expected values as well as Bayes' rule and conditional probabilities). Ideally, you should also have some idea of what a mathematical proof is.

4 Plan

We have 15*2=30 meetings. The idea is to have 20 lectures and 10 exercise classes, i.e. every third class we talk about exercises dealing with the material

of the two previous lectures. *You are expected to have tried to solve the exercises beforehand* (and hopefully you succeeded with some of them), i.e. in the exercise classes we deal with your questions and problems and we are *not* solving the exercises there from scratch.

5   Books

Most material is covered in Mas-Colell et al. (1995) which is abbreviated MWG in the following. Roughly speaking, we will cover chapters 8, 9, 13 and 23 from this book and – as time permits – add a few papers on topics not covered in MWG towards the end of the course.

Some other interesting books on game theory covering the course material partially are

- Fudenberg and Tirole (1991) (FT): Covers an impressive amount of material in considerable depth at PhD level. Some of the proofs are, however, not fully worked out.

- Maschler et al. (2013) (MSZ): Impresses with very clear proofs and fully worked out examples. Do, however, not expect to find much economics in this book.

- Osborne and Rubinstein (1994) (OR). A very nice book that is freely available for download from the authors' websites.

For mechanism design, Börgers (2015) is an excellent source which naturally covers much more than we do in the course.

6   Schedule

The following plan is... well a plan... and as such it might be adapted to unforseen circumstances if necessary.

6.1   Static games of complete information I

- iterative elimination of strictly dominated strategies (MWG 8.B)

- rationalizability (MWG 8.C)

6.2 Static games of complete information II

- mixed strategy Nash equilibrium (MWG 8.D)

- Brouwer's fixed point theorem and existence of Nash equilibrium (MSZ 5.3; MWG 8.Appendix gives a proof using Kakutani's fixed point theorem)

6.3 Static games of complete information III

- correlated equilibrium (MSZ 8)

6.4 Static games of incomplete information I

- Bayesian Nash equilibrium (MWG 8.E)

- simple examples of BNE

6.5 Static games of incomplete information II: Auctions

- first price auction (Gibbons 3.2B or MWG Example 23.B.5)

- second price auction (MWG Example 23.B.6)

- common value auction

- futher not required reading: if you are interested in experiments: Ngangoue and Weizsäcker "Learning from unrealized versus realized prices", working paper, 2018); a detailled source for what we did is Krishna's book "Auction Theory" (academic Press 2010), chapter 2 and 6.

6.6 Dynamic games I

- backwards induction and subgame perfect equilibrium (MWG 9.A and 9.B)

- one deviation principle (MWG 9.B)

- Rubinstein bargaining (MWG 9.Appendix A)

- forward induction (MWG 9.D)

6.7 Dynamic games II

- beliefs and sequential rationality (MWG 9.C)

- perfect Bayesian equilibrium (MWG 9.C)

- sequential equilibrium (MWG 9.C)

- alternative not required reading: OR ch. 12 is a well written piece on the issues mentioned in the lecture; OR ch. 11 covers some more foundational issues that we skipped

6.8 Signaling and refinements

- Spence signaling model (MWG 13.C and MWG 13.Appendix)

6.9 Cheap talk

- Crawford and Sobel (Crawford and Sobel (1982)) (the paper is not super easy to read; so I do not expect you to go through all the details)

- further not required reading: see the article in the New Palgrave Dictionary of Economics on Cheap Talk for a quick overview over the literature, for more on the delegation example see Alonso, Ricardo, and Niko Matouschek. "Optimal delegation." Review of Economic Studies 75.1 (2008): 259-293. (and several other papers by these authors)

6.10 Mechanism design I: revelation principle

- mechanism design problem (MWG 23.B)

- revelation principle (MWG 23.B)

6.11 Mechanism design II: dominant strategy implementation

- Gibbard Satterthwaite theorem (MWG 23.C)

- Pivot (and VCG) mechanism (MWG 23.C)

6.12 Mechanism design III: Myerson- Satterthwaite

- Bayesian implementation (MWG 23.D)

- envelope theorem (MWG 23.D p. 887-889)

- Myerson-Satterthwaite theorem (MWG 23.E)

6.13 Mechanism design IV: screening

- non-linear pricing by a monopolist (see handout)

- a classic reference on this topic is Maskin and Riley (1984), MWG cover a different screening problem in Example 23.F.1 and MWG pp. 897-903 is recommended reading

6.14 Mechanism design V: optimal auctions

- revenue equivalence (MWG 23.D p.889-)

- optimal independent, private value auctions (MWG Example 23.F.2)

6.15 Mechanism design VI: welfare optimal mechanisms and limits

- welfare maximizing mechanism in bilateral trade

- limits when number of agents gets large in bilateral trade and public good setting

- references: Börgers 3.4.3; Fudenberg and Tirole "Game Theory" ch. 7.4.5+7.4.6

6.16 Mechanism design VII: correlated information

- belief extraction

- Cremer-McLean mechanism (Cremer and McLean (1988)) or Börgers ch. 6.4

6.17 Information design I: Bayesian persuasion

- Bayesian persuasion (Bergemann and Morris (2017))

- Further non-required reading: Kamenica and Gentzkow (2011), Bergemann and Morris (2016)

6.18 Information design II

- stochastic dominance

- buyer optimal information design, e.g. Roesler and Szentes (2017)

References

Bergemann, D. and S. Morris (2016). Information design, Bayesian persuasion, and Bayes correlated equilibrium. *American Economic Review 106*(5), 586–591.

Bergemann, D. and S. Morris (2017). Information design: A unified perspective. *SSRN Electronic Journal nil*(nil), nil.

Börgers, T. (2015). *An Introduction to the Theory of Mechanism Design.* Oxford University Press. (with a chapter by Daniel Krähmer and Roland Strausz).

Crawford, V. P. and J. Sobel (1982). Strategic information transmission. *Econometrica 50*(6), 1431–1451.

Cremer, J. and R. P. McLean (1988). Full extraction of the surplus in Bayesian and dominant strategy auctions. *Econometrica 56*(6), 1247–1257.

Fudenberg, D. and J. Tirole (1991). *Game Theory.* Cambridge, Massachusetts.

Gibbons, R. (1992). *A Primer in Game Theory.* Harvester Wheatsheaf.

Kamenica, E. and M. Gentzkow (2011). Bayesian persuasion. *American Economic Review 101*(6), 2590–2615.

Mas-Colell, A., M. D. Whinston, J. R. Green, et al. (1995). *Microeconomic Theory.* Oxford university press New York.

Maschler, M., E. Solan, and S. Zamir (2013). *Game Theory.* Cambridge University Press, New York.

Maskin, E. and J. Riley (1984). Monopoly with incomplete information. *RAND Journal of Economics 15*(2), 171–196.

Osborne, M. J. and A. Rubinstein (1994). *A Course in Game Theory.* MIT press.

Roesler, A.-K. and B. Szentes (2017). Buyer-optimal learning and monopoly pricing. *American Economic Review 107*(7), 2072–2080.