Mini-Course on Mechanism Design
Central European University
February 1st-19th, 2010

Zvika Neeman

Course Outline

The course provides a short introduction to the field known as mechanism design. Mechanism design theory asks when and how it is possible to design rules that induce behavior that is optimal with respect to some given criterion of social welfare. Mechanism design has many applications in economics, ranging from the design of exchange mechanisms, to auctions, price discrimination, regulation, and law and economics. The importance of the field was recently recognized by the Nobel Committee who awarded the 2007 Nobel Prize in Economics to Leonid Hurwicz, Eric Maskin, and Roger Myerson for their contributions to the theory of mechanism design.

The course begins with the classic results of social choice theory (Arrow's and Gibbard & Satterthwaite's Impossibility Theorems), continues with the classic result of implementation theory (Maskin's Monotonicity Result) and ends with the classic results of mechanism design (VCG and AAGV mechanisms; Myerson-Satterthwaite Impossibility; Myerson's optimal auctions). The course concludes with a discussion of the subjects of renegotiation and robust mechanism design, which are on the frontier of current research in mechanism design.

Prerequisites The course is self contained, but basic knowledge of game theory is assumed.

Tentative Lecture Plan
All lectures will take place in FT509.

Social Choice

Monday, Feb 1, 17.30-19.20: Aggregation of Preferences (Arrow's Impossibility Theorem).

Wednesday, Feb 3, 17.30-19.20: Strategy-proof Implementation (Gibbard-Satterthwaite's Impossibility Theorem).

Implementation

Friday, Feb 5, 17.30-19.20: Nash Implementation.

Tuesday, Feb 9, 13.30-15.20: Subgame Perfect and Virtual Implementation.

Mechanism Design

Wednesday, Feb 10, 11-12.50: Groves Mechanisms; AAGV mechanisms.

Thursday, Feb 11, 17.30-19.20: Price Discrimination.

Friday, Feb 12, 17.30-19.20: Bilateral Bargaining under Asymmetric Information; Double Auctions.

Monday, Feb 15, 15.30-19.20: Private Values Auctions; First Price Auction; Second Price Auction. Revenue Equivalence.

Wednesday, Feb 17, 17.30-19.20: Optimal Auctions.

Thursday, Feb 18, 15.30-19.20: Renegotiation.

Friday, Feb 19, 17.30-19.20: Robust Mechanism Design.

Mechanism Design

The text below is taken from the entry "Mechanism Design" that I wrote for the Encyclopedia for the Social Sciences.

Mechanism Design deals with the following types of problems: How to design a "mechanism" or a *game* that has an equilibrium whose outcome maximizes some objective function, such as the maximization of social welfare, subject to certain constraints that depend on the specific problem.

Mechanism design begins with the assumption that each one of the agents for whom the mechanism is designed has access to a different piece of private information, and that elicitation of this information is important for achieving the desired objective. Mechanism design is thus all about incentives: about how to provide the agents with incentives to reveal their private information, and to act in accordance with the designer's objectives. Accordingly, the most important constraint in mechanism design is called "incentive compatibility," or IC. The IC constraint obliges the designer to take into account the fact that the agents will try to manipulate the mechanism to their advantage.

For example, in a famous mechanism design problem the challenge is how to design an auction that maximizes the expected revenue to the seller under the assumption that the willingness of the potential buyers' to pay for the auctioned object is their private information.

The roots of the question of how to collect decentralized information for the purpose of allocating resources can be found in the early debates by economists regarding the feasibility of a centralized socialist economy. These early discussions emphasized the complexity of the systems involved, but it soon became evident that any system for making decisions over the allocation of resources might be open to manipulation. One of the first to recognize the importance of incentives in this context was Leo Hurwicz who coined the term "incentive compatibility" in 1959.

Mechanism design has established itself as a field of study in the early 70s as a result of Hurwicz's work on the possibility of attaining efficient outcomes in dominant strategy equilibria in "economic environments," of Mirrlees's investigation into optimal income taxation schemes, and of the studies of Clarke and Groves of efficient dominant strategy mechanisms for the provision of public goods, which are known today as Vickrey-Clarke-Groves, or VCG, mechanisms (Vickrey has studied such mechanisms in the 60s in the context of his work on auctions). In the late 70s, Arrow and d'Aspremont and Gerard-Varet showed that it was possible to obtain incentive compatible, efficient, and budget-balanced mechanisms. However, in 1983, in their research into optimal mechanisms for bilateral trade, Myerson and Satterthwaite showed that these earlier possibility results might break down if the agents were permitted to refrain from participation in the mechanism if it does not give them an expected utility that is larger than their reservation utility. In 1982, Myerson published a paper on optimal auctions, which to this day acts as the model for implementing mechanism design.

The literature on mechanism design subsequently continued to expand and presently

encompasses price discrimination, regulation, public good provision, taxation, auction design, procurement, the organization of markets and trade, and more.

Mechanism Design has not had the effect on policy anticipated by its early practitioners. This is probably because many of its main results are not robust against changes in the details of the underlying environment (as argued by Robert Wilson in the so called "Wilson Critique"). It still remains to be seen whether the current work on "robust mechanism design" would make the theory more practicable.

References

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