Bachelor's courses School of Business and Economics

VU University Amsterdam - Student- & Onderwijszaken - Exchange programme Vrije Universiteit - 2018-2019

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Mathematical Economics III

Course code	E_EOR3_ME3 ()
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	School of Business and Economics
Coordinator	dr. J.R. van den Brink
Examinator	dr. J.R. van den Brink
Teaching staff	dr. H.E.D. Houba, dr. J.R. van den Brink
Teaching method(s)	Lecture, Seminar
Level	300

Course objective
After this course the students:
-can apply theories and methods learned in Math.Econ. I and II to analyze situations of interaction between different decision makers in economic systems;
-gain a deeper knowledge of economic behavior and allocation in economic organizations;
-are able to critically discuss theoretical results in the context of economic problems,
-are able to apply and choose the appropriate tools for specific decision problems in economics and OR: use complex tools when necessary but use simple tools when these are sufficient;
-are able to design mechanisms and compute solutions for economic behavior and decision making situations such as auctions and identifying the most influential terrorists in a terrorist network;
-are able to read the scientific literature, and write a short paper or research proposal.

Course content
The focus of this course is to apply recent developments in Mathematical Economics to analyze complex systems with the purpose of understanding these systems and being able to make better decisions in economic decision problems. The course will be organized along the following two main themes: (i) Games and networks, and (ii) Auctions. These topics will be taught as separate modules of three weeks each.

Organizations in society and economics become more complex and it requires advanced knowledge of and skills in applying models of decision making in complex economic systems. For example, auctions of radio frequencies, 4G networks, gas station locations along highways etc. require sufficient knowledge of auction theory and mechanism design. Another example is that markets become less anonymous and networks of CEO’s and customer networks become more and more important. Also, with sites as eBay, the internet is growing as an economic system of trade.

Analyzing complex economic systems requires not only knowledge of various theories and methods of economic behavior and economic organizations, but also to be able to combine different theories and methods in an appropriate way. The part on Games and Networks builds on the knowledge of Mathematical Economics 1 (individual, interactive and collective decision making) and Mathematical Economics 2 (cooperative games and networks), and discusses topics that combine different

theories and methods studied before. We do not only give attention to how these concepts can be applied, but also how specific applications require modifications of these concepts. An example is finding the most influential terrorist in a terrorist network where typically the most important terrorists communicate as little as possible, while in a facebook network influential agents use many many links. Typical topics that will be discussed are auction games, systemic risk in financial networks, strategic foundations of cooperative game solutions, games and subjective beliefs, and river water allocation problems.
Attention will be given to behavioral, game theoretic as well as computational aspects.

The second part of the course is devoted to Auction Theory. The approach to Auction Theory shifted from game theory to the design of auctions, called mechanism design and three of its pioneers were awarded the 2007 Nobel-prize in Economics. Nowadays, many consultancy companies specialize in auctions, e.g. TWS-Partners.com, and large multinationals have specialized in-house divisions e.g. Philips Negotiation Lab. In auctions, the focus is on private information held by bidders, bidding strategies, seller's revenue and efficiency. Critical assumptions underlying a successful mechanism design approach, inducing competition among bidders in an unequal playing field, the econometrics of first-prize auctions, jump bids in take-over battles in financial markets and some challenging mathematical techniques will be discussed also. The empirically observed declining price anomaly in sequentially held auctions touches upon behavioral economics, and can be dealt in practice with by holding simultaneous auctions, as successfully applied in the US spectrum auctions (see Wikipedia). A guest lecture will be given by a practitioner of auctions and/or auction design. This part will be examined with a case study in which you are asked to design for example auctions to sell licenses for gas stations along highways, or asked to develop a bidding strategy for a telecom company in a 5G spectrum auction.

Using recent literature, developments in economic behavior and organizations will be studied, and students will play an active role, for example by writing short research proposals.

Form of tuition
Lectures, Tutorials

Type of assessment
Written exam, Home assignments

Course reading
Will be announced in the Course Manual and on Canvas.

Recommended background knowledge
Analysis I and II, Linear Algebra, Probability Theory, Mathematical Economics I and II, and to a lesser extent Statistics and Programming.

Target group
Third year bachelor students Econometrics and OR
International Exchange students with a quantitative interest (for information contact J.R. van den Brink, email: j.r.vanden.brink@vu.nl)