Dutch Network on Computational Game Theory Day

CWI, Science Park 123, 1098 XG Amsterdam
December 2, 2011
Room: L017

Program:

11:00–11:15 **Welcome**

INVITED TALK

11:15–12:15 **Paul Goldberg (University of Liverpool)**
An Overview of Computational Complexity of Certain Nash Equilibrium Computation Problems

Abstract: I give an introduction to the PPAD-completeness results for computing Nash equilibria of games. Then I give an introduction to a new class of PSPACE-completeness results, that use the ideas developed in the PPAD-completeness work. Namely, that it is PSPACE-complete to compute the equilibria that are computed by certain well-known algorithms, such as Lemke-Howson. The talk will be self-contained and will review the definitions of PPAD and the relevant algorithms.

12:15–13:00 **Lunch**

CONTRIBUTED TALKS

13:00–13:30 **Bodo Manthey (University of Twente)**
Stochastic Mean Payoff Games: Smoothed Analysis and Approximation Schemes

Abstract: Stochastic mean payoff games are a powerful class of two-player zero-sum games that generalize, e.g., simple stochastic games and parity games. A stochastic mean payoff game consists of a directed graph with three types of vertices: Black and white vertices belong to the two players, red vertices are random vertices. The edges are labeled with rewards. During the game a token is moved along the edges, and the black player has to pay the white player the corresponding reward. The goal of the players is to optimize their average payment.
The question whether equilibrium strategies and game values of stochastic mean payoff games can be computed efficiently is a long-standing open problem. It is only known that this problem lies in the intersection of NP and co-NP, and there are pseudo-polynomial algorithms for some subclasses. We prove that the existence of pseudo-polynomial algorithms implies, first, the existence of approximation schemes for computing approximate Nash equilibria and, second, that the class has polynomial smoothed complexity, i.e., can be solved efficiently on typical instances.
(Joint work with Endre Boros, Khaled Elbassioni, Mahmoud Fouz, Vladimir Gurvich, and Kazuhisa Makino.)

13:30–14:00 **Mathijs de Weerdt (Delft University of Technology)**
Pricing Mechanism for Real-time Balancing in Regional Electricity Markets

Abstract: We consider the problem of designing a pricing mechanism for precisely controlling the real-time balance in electricity markets, where retail brokers aggregate the supply and demand of a number of individual customers, and must purchase or sell power at the wholesale level such that the total supply matches total demand. This is typically done for future time periods by buying and selling power, and by setting variable prices for retail customers. In real time, balancing can be done through purchase of regulating services, and by remotely controlling portions of their retail customer loads and sources. We enumerate the desirable properties of a market-based balancing mechanism, and analyze the applicability of known mechanism design theory.

14:00–14:15 **Coffee**

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INVITED TALK

14:15–15:15 **Herbert Hamers (Tilburg School of Economics and Management)**
Game Theoretic Centrality Analysis of Terrorist Networks

Abstract: The identification of key players in a terrorist network can lead to prevention of attacks, due to efficient allocation of surveillance means or isolation of key players in order to destabilize the network. We introduce a game theoretic approach to identify key players in terrorist networks. The advantage of this approach is that both the structure of the terrorist network, which usually reflects a communication structure, as well non-network features, which represent individual parameters like financial means or bomb building skills, can be taken into account. The application of our methodology results in rankings of the terrorists in the network. We illustrate our methodology by two case studies: Jemaah Islamiyah's Bali bombing and Al Qaeda's 9/11 attack, which has led to new insights in the operational networks responsible for these attacks. The calculation of the Shapley value plays an important role in this methodology. Since both cases can be represented by relatively small networks, the determination of Shapley value is not time consuming. However, in larger networks the Shapley value may not be determined in polynomial time. In literature several attempts have been made to approximate the Shapley value. A short overview on existing literature on approximating the Shapley value is presented. Finally, the first step to a new approach is presented. (Joint work with Roy Lindelauf and Bart Husslage.)

15:15–15:30 **Coffee**

CONTRIBUTED TALKS

15:30–16:00 **Ulle Endriss (University of Amsterdam)**
Binary Aggregation with Integrity Constraints

Abstract: Binary aggregation deals with situations where several individuals each make a yes/no choice regarding a number of issues and these choices then need to be aggregated into a collective choice. Depending on the application at hand, different combinations of yes/no may be considered rational. We can use an integrity constraint, modelled in terms of a formula of propositional logic, to define the set of those rational choices. Important frameworks of social choice theory, such as Arrovian preference aggregation and judgment aggregation, can be cast as binary aggregation problems, for specific choices of integrity constraints. In this talk, I will present some of our recent work on the interplay of the propositional language used to express integrity constraints and the axiomatic properties of aggregation procedures that can be guaranteed to respect those constraints, and I will show how this general perspective not only is helpful in understanding binary aggregation itself, but also has applications in both preference and judgment aggregation. The talk is based on joint work with Umberto Grandi.

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16:00–16:30 **Tobias Harks (Maastricht University)**
Demand Allocation Games: Integrating Discrete and Continuous Strategy Spaces

Abstract: In this talk, I will introduce a class of games termed demand allocation games that combines the characteristics of finite games such as congestion games and continuous games such as Cournot oligopolies. In a strategy profile each player may choose both an action out of a finite set and a non-negative demand out of a convex and compact interval. The utility of each player is assumed to depend solely on the action, the chosen demand, and the aggregated demand on the action chosen. We show that this general class of games possess a pure Nash equilibrium whenever the players' utility functions satisfy the assumptions negative externality, decreasing marginal returns and homogeneity.If one of the assumptions is violated, then a pure Nash equilibrium may fail to exist. We demonstrate the applicability of our results by giving several concrete examples of games that fit into our model.

16:30–17:00 **Bart de Keijzer (CWI)**
The Robust Price of Anarchy of Altruistic Games

Abstract: We study the inefficiency of equilibria for several classes of games when players are (partially) altruistic. We model altruistic behavior by assuming that player i's perceived cost is a convex combination of $1 - \alpha_i$ times his direct cost and α_i times the social cost. Tuning the parameters α_i allows smooth interpolation between purely selfish and purely altruistic behavior. Within this framework, we study altruistic extensions of congestion games, cost-sharing games and utility games.
We derive (mostly) tight bounds on the price of anarchy of these games for several solution concepts. Thereto, we suitably adapt the smoothness notion introduced by Roughgarden and show that it captures the essential properties to determine the robust price of anarchy of these games. Our bounds reveal a surprising trend: for congestion games and cost-sharing games, the robust price of anarchy increases with increasing altruism; for valid utility games, it remains constant and is not affected by altruism.

18:00 **Dinner** (close to Amsterdam Centraal)