10101 Abstracts Collection
Computational Foundations of Social Choice
— Dagstuhl Seminar —

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Abstract. From March 7 to March 12, 2010, the Dagstuhl Seminar 10101 "Computational Foundations of Social Choice" was held in Schloss Dagstuhl – Leibniz Center for Informatics. During the seminar, several participants presented their current research, and ongoing work and open problems were discussed. Abstracts of the presentations given during the seminar are put together in this paper. The first section describes the seminar topics and goals in general. Links to extended abstracts or full papers are provided, if available.

Keywords. Social Choice Theory, Voting, Fair Division, Algorithms, Computational Complexity, Multiagent Systems

10101 Executive Summary – Computational Foundations of Social Choice

This seminar addressed some of the key issues in *computational social choice*, a novel interdisciplinary field of study at the interface of social choice theory and computer science. Computational social choice is concerned with the application of computational techniques to the study of social choice mechanisms, such as voting rules and fair division protocols, as well as with the integration of social choice paradigms into computing. The seminar brought together many of the most active researchers in the field and focussed the research community currently forming around these important and exciting topics.

Keywords: Social Choice Theory, Voting, Fair Division, Algorithms, Computational Complexity, Multiagent Systems

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Computational Foundations of Social Choice
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Joint work of: Brandt, Felix; Conitzer, Vincent; Hemaspaandra, Lane A.; Laslier, Jean-Francois; Zwicker, William S.

Extended Abstract: http://drops.dagstuhl.de/opus/volltexte/2010/2563

Evaluating the Degree of Manipulability of Certain Aggregation Procedures under Multiple Choices

Fuad Aleskerov (Moscow State University, RU)

The problem of manipulation in voting is studied in the case of multi-valued choice. Well-known and new schemes of preferences extension enabling one to compare all possible social choices under an arbitrary number of alternatives are presented. The known indices of degree and efficiency of manipulation are described, and new indices are introduced. These preference extension schemes and indices are used for computer-aided evaluation of the degree and efficiency of manipulation of the known voting procedures allowing multi-valued choices. The results obtained are presented for five voting rules.

Keywords: Manipulation, multiple choice, voting, social choice

Joint work of: Aleskerov, Fuad; Karabekyan, Daniel S.; Sanver, Remzi; Yakuba, Vyacheslav

Nonmanipulable Selections from a Tournament

Alon Altman (Stanford University, US)

A tournament is a binary dominance relation on a set of alternatives. Tournaments arise in many contexts that are relevant to AI, most notably in voting (as a method to aggregate the preferences of agents). There are many works that deal with choice rules that select a desirable alternative from a tournament, but very few of them deal directly with incentive issues, despite the fact that game-theoretic considerations are crucial with respect to systems populated by selfish agents. We deal with the problem of the manipulation of choice rules by considering two types of manipulation. We say that a choice rule is *monotonic* if an alternative cannot get itself selected by losing on purpose, and *pairwise nonmanipulable* if a pair of alternatives cannot make one of them the winner by reversing the outcome of the match between them. Our main result is a combinatorial construction of a choice rule that is monotonic, pairwise nonmanipulable, and onto the set of alternatives, for any number of alternatives besides three.

Keywords: Tournament, manipulation

Joint work of: Altman, Alon; Procaccia, Ariel D.; Tennenholtz, Moshe

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2010/2560

Data reduction and problem kernels for voting problems

Nadja Betzler (Universität Jena, DE)

Parameterized algorithmics provides the concept of "problem kernelization" based on data reduction. We introduce the general idea and give two illustrating examples of recent work. More precisely, we describe results on problem kernelization for the Possible Winner problem under k-approval voting and experimental results based on data reduction for computing Kemeny rankings.

Joint work of: Betzler, Nadja; Bredereck, Robert; Niedermeier, Rolf

Satisfaction Approval Voting

Steven Brams (New York University, US)

We propose a new voting system, satisfaction approval voting (SAV), for multiwinner elections, in which voters can approve of as many candidates or as many parties as they like. However, the winners are not those who receive the most votes, as under approval voting (AV), but those candidates or parties that maximize the sum of the satisfaction scores of all voters, where a voter's satisfaction score is the fraction of his or her approved candidates who are elected. If individuals are the candidates, SAV may give a different outcome from AV—in fact, SAV and AV outcomes may be disjoint—but SAV generally chooses candidates representing more diverse interests than does AV (this is demonstrated empirically in the case of a recent election of the Game Theory Society). On the minus side, it may encourage more bullet voting than does AV. In party-list systems, SAV apportions seats to parties according to the Jefferson/d'Hondt method with a quota constraint, which favors large parties and gives an incentive to smaller parties to coordinate their policies and forge alliances, even before an election, that reflect their supporters' coalitional preferences.

Keywords: Approval voting, voting systems, representativeness, apportionment, Game Theory Society

Joint work of: Brams, Steven; Kilgour, Marc

Minimal Retentive Sets in Tournaments

Markus Brill (LMU München, DE)

Many problems in social choice can be addressed using tournament solutions, i.e., functions that associate with each complete and asymmetric relation on a set of alternatives a non-empty subset of the alternatives.

For any given tournament solution S, there is another tournament solution $\mathring{S}$, which returns the union of all inclusion-minimal sets that satisfy S-retentiveness, a natural stability criterion with respect to S. Schwartz's tournament equilibrium set (TEQ) is then defined as $TEQ = \mathring{TEQ}$. Due to this unwieldy recursive definition, preciously little is known about TEQ. Contingent on a well-known conjecture about TEQ, we show that $\mathring{S}$ inherits a number of important and desirable properties from S. We thus obtain an infinite hierarchy of attractive and efficiently computable tournament solutions that "approximate" TEQ, which itself is intractable. This hierarchy contains well-known tournament solutions such as the top cycle (TC) and the minimal covering set (MC). We further prove a weaker version of the conjecture mentioned above, which establishes $\mathring{TC}$ as an attractive new tournament solution.

Keywords: Social Choice Theory, Tournament Solutions, Retentiveness, Tournament Equilibrium Set

Joint work of: Brandt, Felix; Brill, Markus; Fischer, Felix; Harrenstein, Paul

Full Paper: http://www2.tcs.ifi.lmu.de/~brandtf/papers/minretentive.pdf

False-Name-Proofness in Social Networks

Vincent Conitzer (Duke University, US)

In mechanism design, the goal is to create rules for making a decision based on the preferences of multiple parties (agents), while taking into account that agents may behave strategically. An emerging phenomenon is to run such mechanisms on a social network; for example, Facebook recently allowed its users to vote on its future terms of use. One significant complication for such mechanisms is that it may be possible for a user to participate multiple times by creating multiple identities. Prior work has investigated the design of *false-name-proof* mechanisms, which guarantee that there is no incentive to use additional identifiers. Arguably, this work has produced mostly negative results. In this paper, we show that it is in fact possible to create good mechanisms that are robust to false-name-manipulation, by taking the social network structure into account. The basic idea is to exclude agents that are separated from trusted nodes by small vertex cuts. We provide key results on the correctness, optimality, and computational tractability of this approach.

Keywords: Mechanism design, false-name-proofness, social networks, voting

Joint work of: Conitzer, Vincent; Immorlica, Nicole; Letchford, Joshua; Munagala, Kamesh; Wagman, Liad

Impossibility results for infinite-electorate abstract aggregation rules

Daniel Eckert (Universität Graz, AT)

It is well known that the literature on judgment aggregation inherits the impossibility results from the aggregation of preferences that it generalises. This is due to the fact that the typical judgment aggregation problem induces an ultrafilter on the the set of individuals, as was shown in a model theoretic framework by Herzberg and Eckert (2009), generalising the Kirman-Sondermann correspondence and extending the methodology of Lauwers and Van Liedekerke (1995). In the finite case, dictatorship then immediately follows from the principality of an ultrafilter on a finite set. This is not the case for an infinite set of individuals, where there exist free ultrafiters, as Fishburn already stressed in 1970. The main problem associated with free ultrafilters in the literature on aggregation problems is however, the arbitrariness of their selection combined with the limited anonymity they guarantee (which already led Kirman and Sondermann (1972) to speak about invisible dictators). Following another line of Lauwers and Van Liedekerke's (1995) seminal paper, this note explores another source of impossibility results for free ultrafilters: The domain of an ultraproduct over a free ultrafilter extends the individual factor domains, such that the preservation of the truth value of some sentences by the aggregate model - if this is as usual to be restricted to the original domain - may again require the exclusion of free ultrafilters, leading to dictatorship once again.

Keywords: Arrow-type preference aggregation, judgment aggregation, model theory, first-order predicate logic, filter, ultrafilter, reduced product, ultraproduct, existential quantifier

Joint work of: Herzberg, Frederik; Eckert, Daniel

Equilibria of Plurality Voting with Abstentions

Edith Elkind (Nanyang TU - Singapore, SG)

In the traditional voting manipulation literature, it is assumed that a group of manipulators jointly misrepresent their preferences to get a certain candidate elected, while the remaining voters are truthful. In this paper, we depart from this assumption, and consider the setting where all voters are strategic. In this case, the election can be viewed as a game, and the election outcomes correspond to Nash equilibria of this game. We use this framework to analyze two variants of Plurality voting, namely, simultaneous voting, where all voters submit their ballots at the same time, and sequential voting, where the voters express their preferences one by one. For simultaneous voting, we characterize the preference profiles that admit a pure Nash equilibrium, but show that it is computationally hard to check if a given profile fits our criterion. For sequential voting, we

provide a complete analysis of the setting with two candidates, and show that for three or more candidates the equilibria of sequential voting may behave in a counterintuitive manner.

Joint work of: Desmedt, Yvo; Elkind, Edith

Voting with Restricted Ballot Languages

Ulle Endriss (University of Amsterdam, NL)

The standard model of voting theory assumes voters with preferences that are total orders, as well as a ballot language that coincides with the preference language. In typical AI scenarios, these assumptions do not hold: certain alternatives may be incomparable for some agents, and others may have their preferences encoded in a format that is different from how the preference aggregation mechanism wants them. I shall discuss the consequences of dropping these assumptions, in particular in view of strategy-proofness.

Joint work of: Pini, Maria Silvia; Rossi, Francesca; Venable, Brent

Full Paper: http://www.illc.uva.nl/∼ulle/pubs/files/EndrissEtAlIJCAI2009.pdf

Campaign Management via Bribery

Piotr Faliszewski (AGH University of Science & Technology - Krakow, PL)

In voting theory, bribery is a form of manipulative behavior in which an external actor (the briber) offers to pay the voters to change their votes in order to get her preferred candidate elected. While bribery is typically associated with cheating in elections, its mathematical model can also be interpreted in terms of campaign management. In this work we study a model of bribery which is particularly well-suited for this campaign-management interpretation. Namely, we consider a model where the price of each vote depends on the amount of change that the voter is asked to implement and we focus on situations where the only allowed action is to shift the briber's (campaign manager's) preferred candidate forward on voters' preference lists. We provide hardness results and polynomial time (approximate) algorithms for this type of bribery in many prominent voting rules.

Joint work of: Faliszewski, Piotr; Elkind, Edith

Strategyproof Selection from the Selectors

Felix A. Fischer (Harvard University, US)

We consider a setting where each member of a set of n agents approves or disapproves of any other member of the set.

Our goal is to design strategyproof and approximately efficient mechanisms (without payments) for selecting a subset of k agents, for a given value of k. Here, strategyproofness means that no agent can improve its own chances of being selected by changing the set of other agents it approves of. A mechanism is called α-efficient for some $\alpha \geq 1$ if the ratio between the sum of approval scores of any set of size k and that of the set selected by the mechanism is always at most α. We show that for $k \in \{1, 2, ..., n-1\}$, no deterministic strategyproof mechanism can provide a finite approximation ratio. We then present a randomized strategyproof mechanism that provides an approximation ratio that is bounded from above by four for any value of k, and approaches one as k grows.

Joint work of: Alon, Noga; Fischer, Felix; Procaccia, Ariel D.; Tennenholtz, Moshe

Probabilistic power indices for games with abstention

Josep Freixas Bosch (UPC - Barcelona Tech, ES)

In this paper we introduce several power indices for games with abstention or with three levels of approval that admit a probabilistic interpretation. We analyze the analogies and discrepancies between standard known indices for simple games and their extensions for this more general setting. We conclude by proposing procedures to compute them.

Keywords: Voting, abstention, power indices, probabilistic interpretations

The Complexity of Manipulating Probabilistic Tournaments

Judy Goldsmith (University of Kentucky, US)

We investigate the complexity of finding satisficing bribes for three voting paradigms that correspond to sports tournaments: cup or elimination, challenge, and round-robin. We assume that, for every pair of candidates i and j, the probability that i beats j is known, and further, the costs of lowering each such probability by fixed increments is known. We provide complexity analyses for five manipulation problems for cup, challenge, and round-robin competitions. These problems range from polynomial time to $\mathrm{NP}^{\sharp\mathrm{P}}$. This shows that the introduction of uncertainty into the reasoning process can drastically increase the complexity of manipulation problems, but in some cases, it does not.

Keywords: Social choice, uncertainty, manipulation

Joint work of: Mattei, Nicholas; Goldsmith, Judy; Klapper, Andrew

The Shield that Never Was: Societies with Single-Peaked Preferences are More Open to Manipulation and Control

Edith Hemaspaandra (Rochester Institute of Technology, US)

Much work has been devoted, during the past twenty years, to using complexity to protect elections from manipulation and control. Many results have been obtained showing NP-hardness shields, and recently there has been much focus on whether such worst-case hardness protections can be bypassed by frequently correct heuristics or by approximations. Our work takes a very different approach: We argue that when electorates follow the canonical political science model of societal preferences the complexity shield never existed in the first place. In particular, we show that for electorates having single-peaked preferences, many existing NP-hardness results on manipulation and control evaporate.

Joint work of: Faliszewski, Piotr; Hemaspaandra, Edith; Hemaspaandra, Lane A.; Rothe, Joerg

Complexity of the aggregation of orders into median orders

Olivier Hudry (ENST - Paris, FR)

Given a collection Π of m individual preferences defined on a same finite set of candidates, we consider the problem of aggregating them into a collective preference minimizing the number of disagreements with respect to Π and verifying some structural properties. We study the complexity of this problem when the individual preferences belong to any set containing linear orders and when the collective preference must verify different properties, for instance transitivity. We show that the considered aggregation problems are NP-hard for different types of collective preferences (including linear orders, acyclic relations, complete preorders, interval orders, semiorders, quasi-orders or weak orders), if the number m of individual preferences is sufficiently large.

Keywords: Complexity, median relations, linear orders, acyclic relations, complete preorders, interval orders, semiorders, quasi-orders, weak orders

See also: Hudry, O.: NP-hardness results on the aggregation of linear orders into median orders, Annals of Operations Research 163 (1), 63–88, 2008.

Approval Balloting for Multi-Winner Elections

Marc Kilgour (Wilfrid Laurier University, CA)

Approval balloting seems a natural approach to multi-winner elections because the objective of the election is to select a subset of the candidates, which is precisely what each ballot specifies.

In this survey of procedures for using a set of approval ballots to determine a winning subset, the class of *admissible*, or potentially winning, subsets is treated as a parameter of the election. Most systems are *scoring* procedures, in which an admissible subset with the highest score wins, but some are better understood as *threshold* procedures, which select an admissible subset that meets some standard of representativeness as often as possible, or *centralization* procedures, which identify an admissible subset that is most "central" in the distribution of ballots. The main purpose of this paper is to collect and classify the procedures, but some comparative properties are mentioned, including some bearing on the implications of common forms of admissibility for computational effort.

Keywords: Approval balloting, multi-winner election, committee election, approval voting

Divide-and-conquer: a proportional, minimal-envy cake-cutting algorithm

Christian Klamler (Universität Graz, AT)

We analyze discrete, proportional cake-cutting algorithms that use a minimal number of cuts ($n-1$ if there are n players) to divide a cake that the players value along one dimension. While these algorithms may not produce an envy-free or efficient allocation - as these terms are used in the fair-division literature - one, divide-and-conquer (D&C), minimizes the maximum number of players that any single player can envy. It works by asking $n \geq 2$ players successively to place marks on a cake - valued along a line - that divide it into equal halves (when n is even) or nearly equal halves (when n is odd), then halves of these halves, and so on. Among other properties, D&C ensures players of at least $1/n$ shares, as they each value the cake, if and only if they are truthful. However, D&C may not allow players to obtain proportional, connected pieces if they have unequal entitlements. Possible applications of D&C to land division are briefly discussed.

Joint work of: Brams, Steven; Jones, Michael; Klamler, Christian

Allocation via Deferred-Acceptance under Responsive Priorities

Bettina Klaus (University of Lausanne, CH)

In many economic environments - such as college admissions, student placements at public schools, and university housing allocation - indivisible objects with capacity constraints are assigned to a set of agents when each agent receives at most one object and monetary compensations are not allowed. In these

important applications the agent-proposing deferred-acceptance algorithm with responsive priorities (called responsive DA-rule) performs well and economists have successfully implemented responsive DA-rules or slight variants thereof. First, for house allocation problems we characterize the class of responsive DA-rules by a set of basic and intuitive properties, namely, unavailable type invariance, individual rationality, weak non-wastefulness, resource-monotonicity, truncation invariance, and strategy-proofness. We extend this characterization to the full class of allocation problems with capacity constraints by replacing resource-monotonicity with two-agent consistent conflict resolution. An alternative characterization of responsive DA-rules is obtained using unassigned objects invariance, individual rationality, weak non-wastefulness, weak consistency, and strategy-proofness. Various characterizations of the class of "acyclic" responsive DA-rules are obtained by using the properties efficiency, group strategy-proofness, and consistency.

Keywords: Consistency, deferred-acceptance algorithm, indivisible objects allocation, resource-monotonicity, strategy-proofness, weak non-wastefulness.

Joint work of: Klaus, Bettina; Ehlers, Lars

Full Paper: http://www.cireq.umontreal.ca/publications/17-2009-cah.pdf

See also: Ehlers, L., Klaus, B.: Allocation via Deferred Acceptance, CIREC Cahier 17-2009, 2009.

The men who were not even there: Legislative voting with absentees

Laszló Á. Kóczy (Óbuda University, HU)

Voting power in voting situations is measured by the probability of changing decisions by altering the cast 'yes' or 'no' votes. Recently this analysis has been extended by strategic abstention. Abstention, just as yes or no votes can change decisions. This theory is often applied to weighted voting situations, where voters can cast multiple votes. Measuring the power of a party in a national assembly seems to fit this model, but in fact its power comprises of votes of individual representatives each having a single vote. These representatives may vote yes or no, or may abstain, but in some cases they are not even there to vote. We look at absentees not due to a conscious decision, but due to illness, for instance. Formally voters will be absent, say, ill, with a certain probability and only present otherwise. As in general not all voters will be present, a thin majority may quickly melt away making a coalition that is winning in theory a losing one in practice. A simple combinatorial model allows us to differentiate between winning and more winning and losing and less losing coalitions reflected by a voting game that is not any more simple. Among other properties this model enables us to verify the intuitively appealing notion that a larger parliament is less democratic using the language of power indices. We use data for selected years in the Hungarian

National Assembly both to illustrate the relation of theoretical and effective power and show our results working in the practice.

Keywords: A priori voting power, power index, being absent from voting, minority, Shapley-Shubik index, Shapley value

How hard is it to control sequential elections via the agenda?

Jérôme Lang (Université Paris-Dauphine, FR)

Voting on multiple related issues is an important and difficult problem. The key difficulty is that the number of alternatives is exponential in the number of issues, and hence it is infeasible for the agents to rank all the alternatives. A simple approach is to vote on the issues one at a time, in sequence; however, a drawback is that the outcome may depend on the order in which the issues are voted upon and decided, which gives the chairperson some control over the outcome of the election because she can strategically determine the order. While this is undeniably a negative feature of sequential voting, in this paper we temper this judgment by showing that the chairperson's control problem is, in most cases, computationally hard.

Keywords: Voting, multiple elections, control, computational complexity

Joint work of: Conitzer, Vincent; Lang, Jérôme; Xia, Lirong

Full Paper: http://ijcai.org/papers09/Papers/IJCAI09-028.pdf

See also: Proceedings of IJCAI-09, 103–108, 2009.

Approval Voting, Theory and Experiments

Jean-Francois Laslier (Ecole Polytechnique - Palaiseau, FR)

This is a survey of recent research on approval voting in experimental economics and social choice. Experimental economics showed that voters behave strategically. This behavior is well captured by game-theoretical models, at the individual level. At the aggregate level, the theory correctly predicts the observation that Approval Voting tends to favor middle-of-road candidates and elect Condorcet winners.

On Welfare Undominated Groves Mechanisms

Vangelis Markakis (Athens University of Economics and Business, GR)

We are interested in identifying mechanisms that maximize the final social welfare generated.

To be able to compare mechanisms with regard to their welfare, we introduce the concept of "welfare undominated" mechanisms. This concept induces a partial order on mechanisms and we study the question of finding minimal elements with respect to this partial order. We focus on two domains, namely, public project problems and multi-unit auctions with unit demand bidders. We show that in the first case the VCG mechanism is welfare undominated. In the second domain we exhibit a family of mechanisms that are welfare undominated and include the Bailey-Cavallo mechanism. In fact we show that among anonymous and linear mechanisms, this family coincides with the set of welfare undominated mechanisms. If time permits, we will also present results on sequential aspects of these mechanisms, where bidders announce their bid sequentially according to some fixed order.

Keywords: Mechanism Design, Social Welfare

Joint work of: Apt, Krzysztof; Conitzer, Vincent; Guo, Mingyu; Markakis, Vangelis

The possible winner problem with a growing set of candidates

Nicolas Maudet (Université Paris-Dauphine, FR)

In some voting situations, some new candidates may show up in the course of the process. In this case, we may want to determine which of the initial candidates are possible winners, given that either a fixed number k or an unbounded number of new candidates will be added.

Joint work of: Chevaleyre, Yann; Lang, Jérôme; Maudet, Nicolas; Monnot, Jérôme

How hard is Kemeny aggregation? and other (Bayesian) statistics with rankings

Marina Meila (University of Washington, US)

People often express their preferences for web pages, products, candidates in an election as a ranked list. Ranked lists are also the standard output of search engines like Google or Sequest. The interest of this talk is to show how one can do "statistics as usual" with this kind of discrete, structured, high-dimensional data. I will define statistical models over spaces of permutations and partial orderings, and present methods for estimating these models from data. I will briefly describe the Maximum Likelihood problem and an algorithm for solving it. Then I will focus on recent work in Bayesian estimation for a class of widely used models called Mallows models. These models have continuous parameters

representing the spread of the distribution and discrete parameters representing a central permutation. Therefore they raise extremely interesting statistical and computational challenges. I will describe the conjugate prior for this model class, and Monte Carlo algorithms for effectively sampling from the posterior, with application to preference data.

Keywords: Preferences, ranked data, exponential models, Maximum Likelihood, Bayesian estimation

Joint work of: Chen, Harr; Ali, Alnur; Mandhani, Bhushan; Bao, Le; Phadnis, Kapil; Patterson, Arthur; Bilmes, Jeff

On the stability of a scoring rules set under the IAC

Vincent Merlin (Caen University, FR)

A society facing a choice problem has also to choose the voting rule itself from a set of different possible voting rules. In such situations, the consequentialism property allows us to induce voters' preferences on voting rules from preferences over alternatives. A voting rule employed to resolve the society's choice problem is self-selective if it chooses itself when it is also used in choosing the voting rule. A voting rules set is said to be stable if it contains at least one self-selective voting rule at each profile of preferences on voting rules. We consider in this paper a society which will make a choice from a set constituted by three alternatives $\{a, b, c\}$ and a set of the three well-known scoring voting rules {Borda, Plurality, Antiplurality}. Under the Impartial Anonymous Culture assumption (IAC), we will derive a probability for the stability of this triplet of voting rules. We use Ehrhart polynomials in order to solve our problems. This method counts the number of lattice points inside a convex bounded polyhedron (polytope). We discuss briefly recent algorithmic solutions to this method and use it to determine the probability of stabillity of {Borda, Plurality, Antiplurality} set.

Keywords: Self-selectivity, Stability, Consequentialism, Ehrhart polynomials

Joint work of: Merlin, Vincent; Diss, Mostapha; Louichi, Ahmed; Smaoui, Hatem

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2010/2561

Non-cooperative approaches to claims or bankruptcy problems

Hans Peters (Maastricht University, NL)

In a claims or bankruptcy problem an estate has to be divided among several claimants whose total claim exceeds the size of the estate.

This paper extends the non-cooperative approach to this problem, as initiated by O'Neill (1982), who also initiated the cooperative, axiomatic approach. In the non-cooperative approach, players put claims on parts of the estate, and these parts are then distributed proportionally with respect to the number of claims. In the model where players have homogenous preferences on the estate, we extend the approach of O'Neill by allowing players to put multiple claims on the same part of the estate, and by considering the case where individual claims may exceed the estate. A full characterization of the set of Nash equilibria is obtained both for restricted claims problems, where individual claims do not exceed the estate, and for the general case. Variations on the claim game are considered, which result in proportional division in equilibrium. This part of the presentation is based on Atlamaz, Berden, Peters, and Vermeulen (revised version, January 2010). In a second part of the presentation the assumption of homogeneity of the preferences is dropped and, instead, we consider much more general preferences. This situation is more difficult to handle and the focus will be on existence of Nash equilibrium. This part of the presentation will be based on forthcoming work of Palvölgyi, Peters, and Vermeulen. The applications extend to more general situations, e.g., multi-item auctions.

Keywords: Bankruptcy problems, claims problems, non-cooperative games.

Joint work of: Atlamaz, Murat; Berden, Caroline; Palvolgyi, Denes; Peters, Hans; Vermeulen, Dries

See also: Atlamaz, M., Berden, C., Peters, H., Vermeulen, D.: Non-cooperative solutions for claims problems, Maastricht University (revised version, 2010).

Palvölgyi, D., Peters, H., Vermeulen, D.: Non-cooperative solutions for claims problems with inhomogenous preferences, Maastricht University (forthcoming, 2010).

Axiomatic Districting

Clemens Puppe (KIT - Karlsruher Institut für Technologie, DE)

In a framework with two parties, deterministic voter preferences and a type of geographical constraints, we propose a set of simple axioms and show that they jointly characterize the districting rule that maximizes the number of districts one party can win, given the distribution of individual votes (the "optimal gerrymandering rule"). As a corollary, we obtain that no districting rule can satisfy our axioms and treat parties symmetrically.

Keywords: Districting, gerrymandering

Joint work of: Puppe, Clemens; Tasnádi, Attila

Degrees of Guaranteed Envy-Freeness in Finite Bounded Cake-Cutting Protocols

Joerg Rothe (Universität Düsseldorf, DE)

Cake-cutting protocols aim at dividing a "cake" (i.e., a divisible resource) and assigning the resulting portions to several players in a way that each of the players feels to have received a "fair" amount of the cake. An important notion of fairness is envy-freeness: No player wishes to switch the portion of the cake received with another player's portion. Despite intense efforts in the past, it is still an open question whether there is a *finite bounded* envy-free cake-cutting protocol for an arbitrary number of players, and even for four players. We introduce the notion of degree of guaranteed envy-freeness (DGEF) as a measure of how good a cake-cutting protocol can approximate the ideal of envy-freeness while keeping the protocol finite bounded (trading being disregarded). We propose a new finite bounded proportional protocol for any number $n \geq 3$ of players, and show that this protocol has a DGEF of $1 + \lceil (n^2)/2 \rceil$. Among known finite bounded cake-cutting protocols for an arbitrary number of players, this is the best DGEF currently known to hold. We will make the case that improving the DGEF even further is a tough challenge, and determine, for comparison, the DGEF of selected known finite bounded cake-cutting protocols.

Keywords: Cake-cutting, fair division

Joint work of: Lindner, Claudia; Rothe, Joerg

See also: Lindner, C., Rothe, J.: Degrees of Guaranteed Envy-Freeness in Finite Bounded Cake-Cutting Protocols. Proceedings of the 5th Workshop on Internet & Network Economics (WINE 2009), Rome, Italy. Springer-Verlag Lecture Notes in Computer Science 5929, pp. 149–159, 2009.

Approval as an intrinsic part of preference

Remzi Sanver (Istanbul Bilgi University, TR)

Approval Voting calls for an extension of the Arrovian preference aggregation model, by incorporating elements of cardinality and inter- personal comparability into individual preferences through assuming the existence of a common zero. We revisit Approval Voting as well as other concepts of Social Choice Theory within this extended model.

Keywords: Approval voting

See also: Forthcoming in Handbook of Approval Voting (eds. Laslier, Jean-Francois and Sanver, Remzi), Springer.

Weighted and Roughly Weighted Simple Games

Arkadii Slinko (University of Auckland, NZ)

This paper contributes to the program of numerical characterisation and classification of simple games outlined in the classical monograph of von Neumann and Morgenstern (1944). One of the most fundamental questions of this program is what makes a simple game a weighted majority game. The necessary and sufficient conditions that guarantee weightedness were obtained by Elgot (1961) and refined by Taylor and Zwicker (1992). If a simple game does not have weights, then rough weights may serve as a reasonable substitute (see their use in Taylor and Zwicker (1999). A simple game is roughly weighted if there exists a system of weights and a threshold such that all coalitions whose combined weight is above the threshold are winning and all coalitions whose combined weight is below the threshold are losing and a tie-breaking is needed to classify the coalitions whose combined weight is exactly the threshold. Not all simple games are roughly weighted, and the class of projective games is a prime example. In this paper we give necessary and sufficient conditions for a simple game to have rough weights. We define two functions f(n) and g(n) that measure the deviation of a simple game from a weighted majority game and roughly weighted majority game, respectively. We formulate known results in terms of lower and upper bounds for these functions and improve those bounds. We also investigate rough weightedness of simle games with a small number of players.

Keywords: Simple game, weighted majority game, trading transform, trade robustness, rough weights, projective games, Hadamard games

Joint work of: Slinko, Arkadii; Gvozdeva, Tatiana

Where are the hard manipulation problems for STV elections?

Toby Walsh (University of New South Wales, AU)

The Gibbard-Satterthwaite theorem proves that, under some simple assumptions, any voting rule is manipulable. That is, it may pay agents not to report their preferences truthfully. One possible escape route, first proposed by Bartholdi, Tovey and Trick is computational complexity. Perhaps it is computationally too difficult to find a manipulation? One of the first voting rules shown to be difficult to manipulate is single transferable vote (STV). It remains today as one of the few voting rules which it is NP-hard to manipulate with unweighted votes. However, there is increasing concern that worst-case NP-hardness results may not reflect the difficulty of manipulation in practice. In this talk, using the phase transition tools described in a recent IJCAI-09 paper, I discuss some recent empirical results in computing manipulations of STV elections.

Keywords: Computational social choice, manipulability, STV voting, NP-hardness

Full Paper: http://www.cse.unsw.edu.au/~tw/conferences.html

Manipulability of Single Transferable Vote

Toby Walsh (University of New South Wales, AU)

For many voting rules, it is NP-hard to compute a successful manipulation. However, NP-hardness only bounds the worst-case complexity. Recent theoretical results suggest that manipulation may often be easy in practice. We study empirically the cost of manipulating the single transferable vote (STV) rule. This was one of the first rules shown to be NP-hard to manipulate. It also appears to be one of the harder rules to manipulate since it involves multiple rounds and since, unlike many other rules, it is NP-hard for a single agent to manipulate without weights on the votes or uncertainty about how the other agents have voted. In almost every election in our experiments, it was easy to compute how a single agent could manipulate the election or to prove that manipulation by a single agent was impossible. It remains an interesting open question if manipulation by a coalition of agents is hard to compute in practice.

Keywords: Computational social choice, manipulability, STV voting, NP-hardness

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2010/2558

Computing and evaluating the unique outcomes of strategic sequential voting games

Lirong Xia (Duke University, US)

Game-theoretic analyses of strategic voting are generally troubled by equilibrium selection problems. In this talk, I will discuss our work on two complete-information models (where the preferences are common knowledge among the voters) that lead to a unique outcome. In one, the voters vote in sequence; in the other, there are multiple binary issues that are sequentially voted on by the voters. We consider a number of related questions, including how to compute the solution (involving a relation to compilation complexity), paradoxes, comparisons to truthful voting, and communication complexity.

Joint work of: Xia, Lirong; Conitzer, Vincent; Lang, Jérôme

False-name-Proof Combinatorial Auction Mechanisms

Makoto Yokoo (Kyushu University, JP)

In Internet auctions, it is easy for a bidder to submit multiple bids under multiple identifiers (e.g., multiple e-mail addresses).

If only one good is sold, a bidder cannot make any additional profit by using multiple bids. However, in combinatorial auctions, where multiple goods are sold simultaneously, submitting multiple bids under fictitious names can be profitable. A bid made under a fictitious name is called a *false-name bid*. In this talk, I describe the summary of existing works and open problems on false-name bids.

Keywords: Combinatorial auctions, mechanism design, false-name bids

Extended Abstract: http://drops.dagstuhl.de/opus/volltexte/2010/2562

Voting Machines

William S. Zwicker (Union College - Schenectady, US)

We begin by demonstrating some interactive software written by Davide Cervone. It simulates rubber bands, or strings with weights and pulleys, to illustrate the different effect of voting with the mean, or with the Ş̃mediancentreT̃ - a spatial version of the median. When each preference ranking is associated with an appropriate vertex of the m-permutahedron, the rubber-band machine implements the Borda count for m alternatives. The strings-and-weights machines implements the Mediancentre Borda, or MCBorda voting rule. MCBorda has unusual properties, and these raise some fundamental questions. When we compare different voting rules to decide which is "better," what are the relationships among decisiveness, resistance to manipulability, and positive responsiveness? Is there actually a difference between a manipulation and a positive response, or are these two sides of the same coin? This last question led, in work with Remzi Sanver, to proposing the One-way Monotonicity property (we'll define it in the talk), a new member of a family that includes: » (Classical) Monotonicity - raising a candidate a in a voter's ranking (without changing the relative preference ranking among the other alternatives) cannot damage a's prospects » Participation - the addition of one more ballot cannot yield an outcome worse, in the eyes of the participating voter, than she would have obtained by abstaining » Half-way Monotonicity (also new) - No voter can gain by completely reversing his ballot. Notice that a failure of half-way monotonicity represents a most extreme form of manipulation, in which a voter gains by totally misrepresenting his true preferences. Via an extension of an argument due to Hervé Moulin, we have shown that every Condorcet extension for four or more alternatives can be manipulated in this way.

Keywords: Median voting rule, Mean voting rule, decisiveness, responsiveness, manipulability, one-way monotonicity

Joint work of: Zwicker, William S.; Cervone, Davide; Dai, Ronghua; Gnoutcheff, Daniel; Lanterman, Grant; Mackenzie, Andrew; Morse, Ari; Sanver, Remzi; Srivastava, Nikhil