MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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Mathematical Game Theory

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Tagungsleiter: J.Rosenmüller (Bielefeld)

Participants of this fourth meeting on Mathematical Game Theory in Oberwolfach came from various countries of Europe, the United States, India, Japan, and the Middle East. Similar to the previous conferences lectures dealing with progress in many areas of game theory research were dominating this meeting. Moreover, informal research groups formed and the traditional "Open Problem Session" took place on Thursday afternoon.

Almost the same emphasis was put upon cooperative and noncooperative game theory. In the first area topics were ranging from the discussion of Nash equilibria in general for certain classes of games, e.g. for repeated games with absorbing states, to the selection of equilibria together with the corresponding definitions of new kinds of equilibria, characterizations, and axiomatizations.

In the cooperative context both games with and without side–payments were considered. Properties of classical solution concepts for certain families of games were presented as well as new solution concepts – related, e.g., to the Shapley value or to the nucleolus – and their axiomatizations. Further topics were covering algorithms for the computation of the nucleolus for families of transferable utility games and "coalition formation".

Common knowledge and information problems as well as game theoretical questions in biology, social choice correspondences for noncooperative game forms, incentive compatible mechanisms and their implementation, and limit theorems for bargaining sets of economies have also been treated in some detail.

Questions arising from problems in optimization and analysis in their relationship to game theory were dealt with in different lectures. Moreover, the application of game theoretical methods in economically motivated models, like exchange economies, played an important role.

Combining cooperative and noncooperative aspects is, nowadays, accepted as a main aim of game theory. This combination reflects the subordinate interest of the whole meeting. Several talks showed that, indeed, cooperation and strategic behavior are strongly related. Additionally, it turned out that the equilibrium concept for several classes of noncooperative games can be axiomatized via well–known properties introduced in the cooperative theory.

Vortragsauszüge

S.Sorin
On the Impact of an Event

Given an information structure we define a function that measures how the information spreads by specifying for each event its impact at each state.

Formally in $(\Omega,\mathcal{A},P)$ let $\mathcal{A}_i$ $i = 1,2$ be the private σ–algebra and assume they are generated by finite partitions X_1 and X_2. Let $F = \{f : X = X_1 \times X_2 \to \mathbb{R}^+\}$ and define for any $f \in F$, $x \in X$ $\varphi(x,f,J) = \max_{\Lambda} T_\Lambda f(x)$ where J stands for the information structure and where Λ is a permutation $(\sigma_1 \ldots \sigma_m)$ of $X_1 \cup X_2$ and $T_\Lambda = T_{\sigma_m} \circ \ldots \circ T_{\sigma_1}$ with finally

$$T_{x_i} f(\tilde{x}) = \begin{cases} f(\tilde{x}) & \text{if} \quad \tilde{x}_i \neq x_i \\ E(f \mid x_i) \vee f(\tilde{x}) & \text{otherwise} \end{cases}$$

φ is the local impact and $\Phi = E(\varphi(\cdot,f,J))$ the global impact. The impact of the event A is $\varphi(x, \Pi_A, J)$. One proves that φ is monotonic in A, subadditive, and expensive. We introduce the notion of exposed component A_x and useful states C_x and prove that we can replace A by A_x and P by its restriction to C_x. Analogous properties of Φ are established. We finally show how this measures the "lack of common knowledge" of an event.

F.Thuijsman
Automata, Matching and Foraging Behavior of Bees

In this paper we discuss two types of foraging strategies for bees. Each of these explicit strategies explains that in the environment of a monomorphic bee community the bees will distribute themselves over the available homogeneous nectar sources according to the Ideal Free Distribution. At the same time these strategies explain that in single–bee experimental settings a bee will match, by its number of visits, the nectar supply from the available sources (the Matching

Law). Moreover, both strategies explain that in certain situations the bees may behave as if they are risk averse.
(joint work with B.Peleg, M.Amitai, A.Shmida)

O.J.Vrieze
The Structure of the Set of Stationary Equilibria in Repeated Games with Absorbing States

For bimatrix games the set of equilibria can elegantly be characterized by the use of maximal Nash subsets. An essential property that enables this characterization is the fact that (x,y_1) and (x,y_2) e.p. then also $(x,\lambda\, y_1 + (1-\lambda)y_2)$ e.p. for each $\lambda \in [0,1]$.

For repeated games with absorbing states this is no longer the case, even for the simple 2×2 case. This failure is due to the fact that for a fixed pure strategy of one player the discounted payoff is in general not linear in the components of the other player. For instance in the 2×2 case these functions are hyperbolic in nature.

In order to find all possible structures for 2×2 repeated games with absorbing states, one can investigate the intersection of the graphs $(x, B_2(x))$ and $(B_1(y),y)$ in the (x,y) plane. Here $B_2(x)$ is the set of all best replies of player 2 against x and $B_1(y)$ has similar meaning. It turns out that every player has best reply structures and that there are 55 different equivalence classes of repeated games with absorbing states (for the 2×2 case).

Extensions to more action cases or to stochastic games lead to systems of polynomial equations in many variables, the solution of which give rise to analytic varieties. One can proof that for these games the set of stationary equilibria consists of finitely many connected components.

S.Muto

Alternating–Move Preplays and vN–M Stable Sets in Two Person Strategic Form games

An alternating–move preplay negotiation procedure for two–person games was proposed by Bhaskar [1989] in the context of a price–setting duopoly. The preplay proceeds as follows. One of the players, say player 1, first announces the price that he intends to take; and then player 2 announces his price. Player 1 is now given the option of changing his price. If he does so, player 2 can change his price. The process continues in this manner; and it comes to an end when one of the two players chooses not to change his price. Bhaskar succeeded in showing that through this process only the monopoly price pair can be attained in equilibrium where the equilibrium is the subgame perfect equilibrium with undominated strategies.

One of the aims of this paper is to examine the validity of the alternating–move preplay process in other two–person games. In addition to the conditions that Bhaskar imposed on equilibria, we require that strategies in equilibrium be Markov (or stationary). It will be shown that the preplay process works well in typical 2 × 2 games such as the prisoner's dilemma and a pure coordination game. The pair of (Cooperation, Cooperation) and a Pareto optimal strategy pair are obtained as the unique equilibrium outcome, respectively. Further in the price–setting duopoly it will be shown that the monopoly price pair can be reached even if the preplay starts from any price pair. The preplay, however, does not always work well. In fact, a sort of the Folk theorem is shown to hold in the prisoner's dilemma with continuous strategy spaces: in the game every individual rational outcome can be attained as an equilibrium outcome.

Another objective of this paper is to study the von Neumann and Morgenstern (vN – M) stable sets in two–person strategic form games. Recently Greenberg [1990] proposed a way to apply vN – M stable sets, or at least its spirit, to strategic form games by appropriately introducing a dominance relation on the space of strategy combinations. Later studies, Chwe [1992] and Muto and Okada [1992], however, revealed that a modification of the dominance relation is desirable as Harsanyi [1974] already pointed out in his study of the vN – M stable set in characteristic function form games. Following Harsanyi's discussion, we will study relations between vN – M stable sets in strategic form games and equilibria in their extended games with preplays.

J. AM Potters

Γ-Component Additive Games

Let (N,ν) be a superadditive game and let Γ be a tree on the set N. The game $(N, R_\Gamma\nu)$ is defined by $R_\Gamma\nu(S) := \Sigma_{T\in S/\Gamma}\nu(T)$ wherein S/Γ is the set of the connected components of S. The map R_Γ is a linear projection from SA^N, the cone of superadditive games to SA^N. The main result of the lecture is the following theorem:

Theorem: If (N,ν) is a Γ-component additive game, the following properties hold:

(1) The core is not empty

(2) The bargaining set and the core are the same set,

(3) The kernel consists of one point, the nucleolus,

(4) The nucleolus is relatively easy to compute.

The proofs of (1) – (3) have been provided as well as an algorithm for the nucleolus.

J.Abdou

Nash and Strongly Consistent Two–Player Game Forms

A two–player game form is Nash–consistent if and only if it is tight (Gurvich). Therefore Nash–consistency of two–player game forms depends only on the effectivity structure. This fact is no longer true for strong consistency. In this paper we introduce a new object called joint effectivity set. These notions are similar though more sophisticated than the usual effectivity functions. We prove that a two–player game form is strongly consistent if and only if it is tight and jointly exact. Joint exactness is a property of the exact joint effectivity set which basically requires that the joint exact effectivity set coincides with the classical effectivity function. As a corollary we have a characterization of two–player strongly implementable social choice correspondences.

R. Selten

An Axiomatic Theory of a Risk Dominance Measure for Bipolar Games with Linear Incentives

Bipolar games are normal form games with two pure strategies for each player and with two strict equilibrium points without common equilibrium strategies. A normal form game has linear incentives, if for each player the difference between the payoffs for pure strategies depend linearly on the probabilities in the mixed strategies used by the other players. A measure of risk dominance between two strict equilibrium points of a bipolar game with linear incentives is characterized by eleven axioms. The measure has the purpose to serve as a structural element of a not yet fully specified equilibrium selection theory for games with linear incentives. This class contains all two–person normal form games but also n–person normal form games which arise from two–person normal form games with incomplete information by looking at the types as separate players. The measure is a weighted average of deviation loss ratio logarithms, with weights derived from influence matrices whose elements describe one player's relative influence on another player's payoff difference. An application to 2–person unanimity games with incomplete information shows that risk dominance in the sense of the measure goes in the direction of the higher generalized Nash–product.

P. Sudhölter

The Modified Nucleolus of a Cooperative Game

A new solution concept for cooperative side payment games is introduced, which is strongly related to the nucleolus and therefore called modified nucleolus. This solution constitutes an attempt to treat all coalitions equally with respect to excesses as far as this is possible. Therefore it is natural to regard the differences of excesses as a measure of dissatisfaction leading to the following intuitive definition. A pre–imputation belongs to the modified nucleolus of a game, if it successively minimizes the maximal differences of excess and the number of coalition pairs attaining them. Alike the pre–nucleolus, the modified nucleolus is a singleton. It has many properties in common with the pre–nucleolus and can be considered as the canonical restriction of the pre–nucleolus of a certain replicated game, called dual cover. An axiomatization provides a theoretical justification of this solution concept, which often reflects parts of the structure of the game. For weighted majority games and for homogeneous games the modified nucleolus generates a representation and the unique minimal integer one respectively. Moreover, this solution concept is characterized by coincidence with the nucleolus for constant–sum games, Pareto optimality, and a further property in the weighted majority case. A dynamical approach shows the stability of the modified nucleolus.

E. van Damme

Endogenous Timing and Strategic Commitment

Say that a player has an incentive to move first at a Nash equilibrium if this player has a higher payoff when she is allowed to act as a Stackelberg leader, i.e. when the payoff of this player in the subgame perfect equilibrium of the game in which this player moves first is larger than this player's payoff in the Nash equilibrium. In the literature one finds claims that a Nash equilibrium is viable only if no player has an incentive to move first at it. We investigate the validity of this claim by using the following 2–stage model (for 2–person games):

Stage 1: Simultaneously the players choose between taking an action or waiting.

Stage 2a: Each player is informed about what the other has done.

Stage 2b: A player who chooses to wait in stage 1 now chooses an action, with different players choosing simultaneously.

We derive the following results.

Prop 1: Let g be a generic game (satisfying the Lemke/Howson condition).

A (strictly) mixed equal of g can be obtained as a Nash equal outcome of the timing game if and only if no player has an incentive to move first at it.

Prop 2: A (strict) pure equilibrium s^* of a game g can be obtained as a perfect equilibrium outcome of the timing game if $u_i(s^*) > \min_{s_j} u_i(s_i^*, s_j)$ for $i = 1,2$.

Prop 3: Let s^* be a pure equilibrium of g and force players to play s^* in the second period of the timing game if they both still have to choose. Denote this reduced game by $g^2(s^*)$. Then s^* is a perfect equilibrium outcome of $g^2(s^*)$ if and only if no player has an incentive to move first at it.

Prop 4: Assume s^* is the only equilibrium of g at which no player has an incentive to move first. Then s^* is the unique persistent (resp. primitive, resp. curb, resp. curb*) equilibrium outcome of the timing game.

These results show how the claims from the literature are incorrect, resp. how they can be made correct.

T.E.S.Raghavan

The Nucleolus for Assignment Games

Assignment games with side payments are models of certain two–sided markets. It is known that prices which competitively balance supply and demand correspond to elements in the core. An algorithm is presented that determines the nucleolus that lies in the core. It generates a finite number of payoff vectors, monotone increasing on one side, and decreasing on the other. The decomposition of the payoff space and the lattice–type structure of the feasible set are utilized in associating a directed graph. Finding the next payoff is translated into determining the length of longest paths to the nodes, if the graph is acyclic, or otherwise, detecting the cycles. In an (m,n) person assignment game with $m = \min(m,n)$, the nucleolus is found in at most $\frac{1}{2} \cdot m\,(m+3)$ steps, each one requiring at most $O(m \cdot n)$ elementary operations.

Essentially the algorithm could start at the special corner in the core favoring all sellers by giving the fruit of cooperation of coalitions $(i,\sigma(i))$ to seller i for an optimal assignment σ. Starting with the partition $\Delta \supseteq \{(i,\sigma(i));\ i = 1,2...m\}$ we can consider the so called settled two person coalitions that have constant satisfaction on the polyhedra which is the core. The partition $(\Delta, \Delta^c = \Sigma)$ of two person coalitions induce an equivalence class on sellers. A certain associated graph induces a direction to move inside the core with one end at the seller favoring corner. The speed is determined by the new payoff that brings yet another coalition of two players that has the same satisfaction as the current one with the new payoff. A new iteration begins once a cycle is found in an adjoining graph. Deleting cycles from further consideration lead to efficient computation of the nucleolus for these special games.

A.S.Nowak

Solidarity Values and Weighted Shapley Values

We introduce axiomatically a new value for cooperative transferable utility games which satisfies the efficiency, additivity and symmetry axioms of Shapley and some new postulate concerning the average marginal contributions of the members of coalitions which can form. Our solution is referred to as the solidarity value. The reason is that it is based on some "solidarity beliefs" of the players. The formula defining the solidarity value is as follows

$$\psi_i(v) = \sum_{T \ni i} \frac{(n-|T|)!(|T|-1)!}{n!} \left[\frac{1}{|T|} \sum_{k \in T} (v(T) - v(T \setminus k))\right]$$

for any game v and every player i.

It is proved that the solidarity value is the unique value which satisfies the efficiency, additivity, symmetry axioms of Shapley and the following assumptions (A):

(A) If for each $S \ni i$, we have $\frac{1}{|S|} \sum_{k \in S} [v(S) - v((S-k)] = 0$, then the value of player i in the game v is equal to zero.

Our second result concerns the family of weighted Shapley values. We provide an axiomatic characterization of the weighted Shapley value for exogenously given weights of the players. Next, we give a new characterization of the family of weighted Shapley values which includes the strong monotonicity property of Young and does not use the partnership axiom of Kalai and Samet.

The results mentioned above are contained in papers written jointly with T.Radzik.

S.H.Tijs

Axiomatic Characterizations of Nash Equilibria

For closed families of strategic games we characterize the NE–correspondence as the unique solution satisfying consistency, converse consistency and one–person rationality. We also consider the question whether we can replace the converse consistency property be the non–emptiness property. Here we obtain positive and negative answers depending on the properties of the considered class of games. Special attention is paid to classes of potential games. Also axiomatizations of other strategic solutions will be discussed shortly.

References:

[1] B.Peleg and S.Tijs. The consistency principle for games in strategic form. Discussion Paper, Center for Rationality and Interactive Decision Theory, The Hebrew University of Jerusalem, 1992.

[2] B.Peleg, J.Potters and S.Tijs. Minimality of consistent solutions for strategic games with a special application to potential games. Working paper, 1993.

W.Güth and B.Peleg

Formation of Rings in Auctions

We investigate a two–stage model of ring formation in auctions. It is assumed that first ring members bid in a preauction or knockout and that then only the ring's representative repeats his bid in the subsequent main auction. The rules must specify for every vector of bids who represents the cartel in the main auction, which transfers he has to pay to other ring members to compensate them for abstaining from bidding in the main auction, who wins the main auction, and finally which price has to be paid. Most of the rules can be derived instead of being imposed by requiring envy–free net trades with respect to bids. We analyze all symmetric envy–free auction mechanisms using the following steps.

(1) For each possible ring we find the differential equation for the ring's (symmetric) bidding strategy.
(2) Solve the differential equation (if possible)
(3) Prove that the solution of (2) is a bidding strategy for the ring.

(4) Prove that the foregoing strategy is more profitable (for the members of the ring) than competitive bidding.

(5) Prove that the ring's strategy cannot be improved upon by subrings (when also subrings are restricted to symmetric strategies).

A.Ostmann

Coalition formation in Simple Games

Observed behavior in multilateral bargaining in conflicts induced by monotone superadditive simple games can be rather complex and not easy to describe. More formal statements like proposals, saying yes or no make up only a small part of the bargaining. Nevertheless in many cases abstracting from socio–emotional processes and assuming identical subjects is adequate for the central phase of the bargaining process. Here it can be assumed that actual aspirations $y = (y_1,...,y_n)$ are more or less adapted to the system $\mathscr{M}$ of minimal–winning coalitions S : i.e., $y(S) \lesssim 1+\epsilon$ or in matrix notation $My \lesssim 1(1+\epsilon)$, ϵ small,

$M = \begin{bmatrix} \vdots \\ 1_S \\ \vdots \end{bmatrix}_{S \in \mathscr{M}}$. An important consequence is that the bargaining process can be identified with a sequence of minimal–winning coalitions. A family of processes governed by a transition matrix $P = \begin{pmatrix} A & D \\ O & I \end{pmatrix}$, $D = \text{diag}\,(1-g)$, $g = (g_S) > 0$ was introduced and analyzed. g_S is the probability of canceling a proposal S. Let W be the stochastic normalization of A then a canonic process is derived for $W = (\text{non } M)'\,(M^T)'$ (' denotes the stochastic normalization).

THEOREM: For $\# \mathscr{M} \neq 2$ W^n, converges to $\begin{pmatrix} \vdots \\ \underline{w} \\ \vdots \end{pmatrix}$, $\underline{w}$ being the unique stochastic left Eigenvector of W for Eigenvalue 1 (unique, maximal, multiplicity 1) <u>and</u> the process (p_0,P) can be approximated by a companion process (p_0,Q),

$$Q = \begin{bmatrix} g_S \underline{w}_T & D \\ 0 & I \end{bmatrix}$$; essentials of Q are easy to compute.

In a further part a theory for determining g was derived, resulting in $g_S = 1 - \binom{n-1}{s-1}^{-1}$ (Proof by induction). Finally examples for different games have been discussed.

E.Einy

Coalition–Proof Communication Equilibria

We offer a definition of coalition–proof communication equilibria. The use of games of incomplete information is essential to our approach. Deviations of coalitions are introduced after their players are informed of the actions they should follow. Therefore, improvements by coalitions on a given correlated strategy should always be made when their players have private information.

Coalition–proof communication equilibria of two–person games are characterized by "informational efficiency". Several examples are analyzed, including the Voting Paradox.

(joint work with B. Peleg)

B.Allen

Cooperative Games and Super Implementation with Asymmetric Information

We examine the cooperative games with nontransferable utility that result when the state–dependent allocations that agents can achieve in an exchange economy must satisfy an implementation requirement. Both Bayesian and full implementation concepts are considered, but the important distinction compared to the literature is that I do not restrict myself to a single mechanism because there may be no relation between a mechanism for the grand coalition and one for a subcoalition. To begin, I study the sets of state–dependent allocations that can be implemented by some mechanism. The mechanism can possibly depend on the allocation, although I show that this generalization doesn't enlarge the set beyond the implementable allocations for some "super mechanism" with sufficiently large message space. Under a nonatomicity assumption, the set of super implementable imputations is convex. Moreover, if an allocation is (super) implementable for a submarket, then it forms part of at least one (super) implementable allocation for the entire economy. The resulting game is superadditive. Existence of the superimplementable (NTU) value is shown. Implicitly, this provides a cooperative selection of mechanisms based on agent's marginal contributions with (noncooperative) strategic use of information.

T.Ichiishi

Cooperative Processing of Information

The Nash equilibrium concept of a normal–form game has been extended in several directions in the past: One direction is to introduce asymmetric information explicitly into the normal–form game. The resulting model is Harsanyi's (1967/1968) Bayesian game. His Bayesian equilibrium concept extends the Nash equilibrium concept to this new framework. Another direction is to introduce the possibility of coordination of strategies by several players. For this purpose, the model of society was proposed as a synthesis of the normal–form game and the non–side–payment game, and the social coalitional equilibrium concept for a society was proposed as a synthesis of the Nash equilibrium and the core.

A new model of the Bayesian society is formulated here, both as a cooperative extension of the Bayesian game and as a Bayesian extension of the society. A new solution concept of the Bayesian strong equilibrium is proposed for a Bayesian society, which extends both the Bayesian equilibrium and the social coalitional equilibrium. There arise new issues intrinsic to this extension, so there are actually several versions of the Bayesian strong equilibrium concept. Three situations are discussed, each giving rise to the associated specific equilibrium concept.

The first situation, called the I–P case (information pooling case), postulates that coalition S can pool its members' private information, so a strategy bundle (contract) for S can be designed so as to take advantage of the pooled information. Bayesian strong equilibrium existence theorems are established for this case.

The second situation, called the I–NP case (information non–pooling case), postulates that nobody in coalition S can use the others' private information at the time of contract–execution. The members of S can design only strategy bundles such that player j's strategy is based solely on his own private information. In this case, j knows that the others do not have his private information at the time of contract–execution, so he may take a false action in his own interest by misrepresenting his private information; no strategy bundle leaving this possibility open can be agreed upon at the outset. Thus, the Bayesian incentive compatible strong equilibrium concept is introduced in this case, and its existence theorems are established.

The third situation is based on a specific structure added to the model of Bayesian society. Due to this structure, one can analyze how player j, in pursuit of his own interest, passes on to the other members of S some of his private information. The associated (more involved) concept of Bayesian incentive compatible strong equilibrium is proposed. The pseudo–metric space (SPACE, d) of all logically conceivable Bayesian societies having this additional structure is constructed, and it is established that there exists an open and dense subset $SPACE_0$ of SPACE so that every Bayesian society in $SPACE_0$ possesses a Bayesian incentive compatible strong equilibrium.

R. Harstad

Auctions with Endogenous Bidder Participation

In many economic markets of interest, the number of competing bidders responds endogenously to profitability. Yet mainstream models of auctions have always assumed a fixed number of bidders. This considers the following extensive form:

1. A seller of an indivisible asset announces an auction mechanism, specifying rules and information flow, in particular, a reserve price, a royalty rate, and a positive or negative entry fee.
2. Each of N potential bidders simultaneously selects a probability of participation. Participation incurs a resource cost and obtains private information, an estimate of asset value.
3. Each participant simultaneously decides whether to become an actual bidder. Each actual bidder pays the entry fee.
4. Each actual bidder selects a bidding strategy.

The assumptions are general; all extant symmetric models are special cases. Behavior is supposed to be a symmetric Bayesian equilibrium. Participation is typically a mixed strategy.

The equilibrium probability equates expected profitability to participation cost.

This yields the fundamental identity that expected revenue equals expected asset value less expected aggregate participation costs, for any auction mechanism. Thus, no separate revenue formula is needed for 1st price, 2nd price or English auctions, nor do reserve prices, entry fees or royalty rates enter into the formula. Seller's preferences are then coincident with those of a social efficiency calculation.

If negative entry fees are possible, any participation probability can be obtained as an equilibrium for a 2nd–price auction without reserve price. A corollary is that a nontrivial reserve price is a revenue–inferior strategy.

Equilibrium revenue can be expressed solely as a function of the participation probability. Under a mild asymptotic linearity assumption, that function is strictly concave.

Underlying parameters divide into two regions. In the overattractive region, all extant expected revenue comparisons are generalized, as seller wishes to reduce the equilibrium participation probability. In the underattractive region, all extant revenue comparisons are reversed. Any given auction in any given environment can be brought into the overattractive region by a sufficient decrease in the participation cost or by a sufficient decrease in the precision of private information.

T.Parthasarathy

A Solution to an Old Problem of Samuelson

Paul Samuelson, the well–known economist suggested a condition for univalence of differentiable self–maps of R^n in a seminal paper on the theory of general equilibrium in economics. His goal was to provide a sufficient condition for "full factor price equalization". In this talk we present a contribution to this problem when the determinant of the Jacobian is positive (negative) and other principal minors are negative (positive). Proof of this result depends on an old result of Kaplansky on completely mixed games and on a well–known result of Knaster—Kuratowski–Mazurkiewicz (lemma). We will also discuss the case when the maps are polynomials.

U.Krengel

Minimax Strategies for the Best Choice Problem with Full Information and Order Selection

Gilbert and Mosteller (1966) distinguished two forms of the best choice problem (= secretary problem). In the rank problem only the relative ranks of the items arriving in random order can be observed, and the aim is to stop so as to maximize the probability of stopping when the best item is shown. In the full information case the value of the items is given by independent random variables with known continuous distribution, and these random variables can be observed.

Gilbert and Mosteller also studied a game variant of the rank problem: Player 1 presents the items in an order which he selects. (This is the worst case situation when the assumption of arrival in random order is violated.) The solution of the game variant in the full information case will be presented.
(joint work with A.Gnedin)

T.Radzik

Generalized Shapley Values in Cooperative TU–Games with Directed Graphs

We consider cooperative TU–games with graphs described by $<N,v,A>$, where N is the set of players, $v\colon 2^N \to R$, and A is a directed graph describing the possible communication paths between the players. We study the following two problems:

(1) How to construct the "real worth" $v_A(N)$ of the grand coalition, and

(2) How to divide this amount $v_A(N)$ among the players.

We find three very natural constructions of the function $\hat{v}(S)$, $S \subset N$, and, next, three corresponding values $\Phi(v,A)$ are discussed.
It is shown that one of these values can be axiomatized in a very similar way given by Myerson (1977) for games $<N,v,A>$ with undirected graphs. That value coincides with the so–called generalized Shapley value (A.S.Nowak,

T.Radzik, 1992) defined on the set of generalized cooperative TU–games (the new concept for cooperative games, where coalitions are considered to be sequences of the players – instead of subsets of N, as in the classical approach).

J.Rosenmüller
Bargaining with Incomplete Information

In a Nash bargaining situation with incomplete information we parametrize a system of feasible sets in a "canonical" way; in particular the "fee–game" represents the (complete information) analogue to the side payment game. Let us introduce Bayesian incentive compatible mechanisms. Then for two persons and arbitrarily many types a mechanism is globally efficient only if it is constant.
Also, in a nonconstant ex ante P.E. mechanism, given the situation of incomplete information on one side, the informed player obtains zero utility in his worse situation.

Next, it is shown that such a nonconstant mechanism yields as for player 1 (the informed one) a worse utility payoff as compared to the expected contract utility. Therefore, the Axiom of the Expected Contract states that whenever this contract is in mediis i.r. and BIC, a bargaining solution should choose it. Finally, we propose a version of the IIA Axiom and show that (including the traditional invariance and efficiency axioms) there is a unique solution satisfying the axioms. This value also satisfies the E.C. Axiom.

W.Trockel
On the Bargaining Set of Large Exchange Economies

Mas–Colell (1989) has proved that in a non–atomic continuum economy the competitive allocations coincide with those in the Bargaining Set. His concept of the bargaining set modifies older ones used in TU–games. Our problem is it to check whether, analogosly to equivalence between competitive and Core allocations, also a limit theorem is true, which gives approximate equivalence for large finite economies. It is shown that no analog of the Debreu–Scarf Theorem exists for the Mas–Colell bargaining set. A modification of the bargaining set following

Geanokoplos who explicitly considers leaders of objecting coalitions is introduced for exchange economies. Two limit theorems are proved yielding approximate equivalence of this bargaining set with the set of competitive allocations. The proof is based on that of Mas–Colell (1989), substituting Lyapunow–Richter's Theorem by Shapley–Folkman's Theorem to get convexifying effects, and on a former work by Anderson (1978).
(joint work with R.Anderson)

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