**Program of the Autumn School "Advances in Decision Analysis"**
**to be held in HSE University online**
**November 27-29, 2023**

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**11.00-12.00 Moscow time (msk)**
**Chinese Digital Economy: Development and Future Trends**
**Yong Shi (Chinese Academy of Sciences)**

**Abstract:** The digital economy has become a significant force in reorganizing global resources, reshaping the structure of worldwide economy, and changing global competitive landscape. In this talk, it starts with the basic concepts of digital economy. Second, the history of development regarding major international digital economies and the current status of China's digital economy are reviewed. Then, the talk especially illustrates the recent new advances that emerged in the evolution of digital economy. Finally, several suggestions of policies to promote, optimize, and strengthen China's digital economy are proposed, which are data openness and protection, key technologies, training programs for talents, livelihood services for citizens, social credit system establishment, and international collaborations.

**12.00-13.00**
**Multicriteria decision making with interactive criteria**

**Michel Grabish (Universite Paris 1 Pantheon Sorbonne)**

In most practical situations, making decision is done under considering several points of view or criteria, and they are rarely independent. However, most decision models consider implicitely that criteria are independent. Interaction between criteria can be modelled via capacities, acting as a general scheme to define weights on criteria and groups of criteria. Capacities permit to define in a rigorous way interaction between criteria. This lead to the definition of an interaction index, generalizing the Shapley value and similar power indices, as the Banzhaf value. Depending on measurement conditions and assumptions on preferences, two general aggregation operators can be defined in order to produce an overall score of an alternative: the Choquet integral or the multilinear model.

**13.00-14.00**
**The role of information and voters' interaction in manipulation problem**

**Yulia Veselova (HSE University)**

**Abstract.** Collective decision making is a part of everyday life of the modern society. People invented a variety of voting procedures for aggregating individual preferences into a collective choice. However, the problem is that people can misrepresent their preferences in order to achieve a more preferable voting result. This phenomenon is called manipulation and considered as negative, since due to manipulation the voting result becomes biased. We consider several models of manipulation in voting which take into account possible incompleteness of

information available to voters and voters' interaction. We start from the concept of safe manipulation and consider strategic voters of different levels of cognitive hierarchy under incomplete information in the final. It is demonstrated that public information and voters' view of the behaviour of others are the crucial aspects that affect individual manipulation incentives. For certain conditions rules become immune to manipulation and we find such cases.

**14.30-15.30**
**Equitable Stable Matchings Under Modular Assessment**

**Ahmet Alkan (Sabanci University) and Kemal Yildiz (Bilkent University)**

Abstract : We propose a framework for addressing issues of equity and social welfare in the stable matching model. We first establish an equivalence between an ordinal condition and modular optimization on the lattice of stable matchings. This equivalence charts out a domain where equity or welfare criteria separate over individuals and appear as weights in optimization. We call the ordinal condition "convexity" and the domain "modular". Convexity requires stable "mixtures" of solutions to also be in the solution. We then offer several characterizations.

**November 28, 2023**

**11.00-12.00 msk**

**Decisions over Sequences**

**Bhavook Bhardwaj and Siddharth Chatterjee (Indian Statistical Institute, Delhi Center)**

**Abstract.** This paper introduces a class of objects called decision rules that map infinite sequences of alternatives to a decision space. These objects can be used to model situations where a decision maker encounters alternatives in a sequence such as receiving recommendations. Within the class of decision rules, we study two natural subclasses —stopping and uniform stopping rules. Our main result establishes the equivalence of these two subclasses of decision rules. Next, we introduce the notion of computability of decision rules using Turing machines and show that computable rules can be implemented using a simpler computational device — a finite automaton. We further show that computability of choice rules — an important subclass of decision rules—is implied by their continuity with respect to a natural topology. Finally, we introduce some natural heuristics in this framework and provide their behavioral characterization.

**12-00-13.00**

**Power Index Elegy**

**Manfred J. Holler (University of Hamburg and Center of Conflict Resolution, CCR)**

**Abstract.** Felsenthal and Machover (1998) introduced the differentiation of P-power and I-power to the measurement of voting power in voting bodies. P-power is about sharing power and the spoils related to it, and I-power is capturing the influence of a voter on the outcome.

However, it is not the mathematical apparatus that decides whether an index is measuring P-power or I-power but the subject under analysis, i.e., the "story" decides whether the Shapley value is an appropriate tool or not. Felsenthal and Machover classified the Public Good Index as a measure of P-power.

**13.00-14.00**

**A tool for quantitatively analyzing the chances of a university to compete in the world market of new students**

**Alexander S. Belenky (HSE University)**

**Abstract.** Two problems of economics of distance education associated with developing so-called blended courses for universities by including in these courses fragments of lectures of professors from distinguish universities in the world are considered. For a particular University, the first problem consists of maximizing the minimal percentage of the total number of students who are expected to succeed in studying a particular course from a set of blended courses when these courses a) are viewed by the University as equally important and are expected to be offered within the next few years, and b) are to be offered within a limited yearly budget. The second problem (for the same University) consists of minimizing the yearly budget allocated for running all the offered blended courses provided that a percentage of the students expected to succeed in studying the courses will not be smaller than a particular number. A mathematical model is proposed for both problems, and based on the model, these problems are formulated as Boolean programming ones (that can be solved using standard software packages). The formulated problems can be viewed as a tool helping universities negotiate financial problems with federal authorities and private sponsors on providing competitiveness in the world market of new potential students. The status of the research results in this field is also discussed.

**November 29, 2023**

**11.00-12.00 msk**

**Set-alternating schemes: A new class of large Condorcet domains**

**A. Karpov (HSE University, ICS RAN), K. Markström (Umea University), S. Riis (Queen Mary University of London), B. Zhou (Queen Mary University of London)**

**Abstract.** A new scheme to construct Condorcet domains is introduced. This scheme leads to domains which are copious, connected, and peak-pit. The resulting family of domains includes some of Arrow's single-peaked domains of size $2^{(n-1)}$, which we prove to be the smallest possible domains. New scheme also leads to domains larger than the domains of Fishburn's alternating scheme. Thanks to the concise form of our schemes, we can analyze the growth of our fastest-growing domains. We show that the domain size for sufficiently high n exceeds $2.1973n$, improving the previous lower bound $2.1890n$ from (Karpov, Slinko 2023). To perform this analysis, a bijection between suborders and Dyck words, counted by the Catalan numbers, is developed.

**12.00-13.00**

**Exploring Beyond Manipulability: Unveiling Additional Dimensions of Voting Rules and Their Interplay with Manipulative Behavior**

**Daniel Karabekyan (HSE University)**

**Abstract:** The degree of manipulability, representing the proportion of all manipulable profiles or voting scenarios, is a widely utilized metric for comparing voting rules. In this presentation, I will delve into alternative measures that offer insights into the characteristics of voting rules, namely stability and resoluteness. I will demonstrate that rules requiring minimal information about preferences, such as Plurality, Hara, and Threshold, exhibit higher levels of stability. Furthermore, in terms of resoluteness, rules with built-in tie-breaking mechanisms like Hara (Instant Run-off) or Threshold rule emerge as particularly robust. The analysis extends to the simultaneous consideration of resoluteness and manipulability, categorizing changes based on the probability of ties in sincere voting situations or situations post-manipulation. A key finding is the prevalence of manipulation occurring either from or to tied choices; for many rules, including Plurality and Borda, this phenomenon approaches 100%.

**15.00-16.00**

**New Methods of Pattern Analysis: Theoretical Aspects and Practical Application**

**Aleksey Myachin (HSE University)**

**Abstract:** The theoretical aspects of certain new methods of pattern analysis are presented (ordinal-interval pattern clustering and Bayesian pattern analysis). Individual properties of methods have been studied that can significantly reduce computational complexity, which makes it possible to work with large datasets. A method for reducing the dimensionality of data using pattern analysis methods based on pairwise comparison of indicators is considered. The method is applied to synthetic data, classical datasets and to practical examples: when predicting the incidence rate of COVID-19 in countries around the world, as well as when studying pricing in Russian universities.