Editorial

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Biographical notes: Ferenc Szidarovszky is a tenured full Professor at the University of Arizona, Tucson, Department of Systems and Industrial Engineering. He received his education and all degrees in Budapest, Hungary from the Eötvös University of Science and from the Hungarian Academy of Sciences. He has lived in the USA since 1987. His research interests include dynamic systems, computer methods, decision making, conflict resolution, game theory, simulation and their applications in natural resources management, economics and management. He is the author or coauthor of eight books published in Hungary, as well as 12 textbooks and monographs published in English, in addition to over 250 papers published in leading international journals. He is associate editor and editorial board member of eight scientific journals including Concrete and Applicable Mathematics, Scientia Iranica and this journal.

Our everyday life is a sequence of decisions, starting from the time to wake up, selecting breakfast and clothes for the day, the route to drive to work etc. These individual decisions are sometimes hard to be made even if they have only small consequences. Many economic, business and political decisions have large impact on the entire society, so they have to be made very carefully and by counting on all consequences. Therefore decision making is a very complex science that includes technical, economic and social issues among others. In the literature there are many different classifications of decision making problems. If the number of decision makers is our main concern, then we can distinguish between single or multiple decision maker's problems. If there are more than one decision makers, then their relation to each other and their behaviour are important factors in predicting the decision outcome or in finding an appropriate decision outcome. Noncooperative or cooperative game theory including group decision making and conflict resolution is the most common methodology to deal with such problems. There are many different solution concepts known from the literature including Nash equilibrium in the noncooperative case, and kernel, core, von Neumann stable set, Shapley value and many others in the case of cooperating decision makers.

The structure of the decision space is the basis of another way of classifications. If there is a finite alternative set to chose from, then the problem is called discrete, and if it is a continuous connected set (e.g., interval, or an entire vector space) then the problem is continuous. There are also problems with mixed type of decision space. The number of decision criteria gives another way of classification. We can distinguish between single and multi-criteria decision making problems. Multiobjective optimisation and Pareto games are typical examples of problems with multiple criteria. If there is only one criteria, then we face with a single objective decision problem.

There is a large variety of results dealing with the existence, uniqueness of the solutions of decision making problems as well as with methodology to find solutions. Unfortunately most theoretical results on existence and uniqueness are based on special conditions and assumptions which do not hold in general. In addition, the computer methods assume a relatively small number of decision makers and individuals being affected by the decisions. In most issues involving a large part of the society and a large number of individuals with complex behavioural patterns cannot be modelled and treated with analytical methods, and to obtain nice mathematical solution is impossible in most cases. It is also very difficult and usually impossible to predict the combined effects of individual decisions, complicated behavioural patterns and personality issues to a large society in rigorous mathematical way.

The most effective way of modelling and analysing individual actions and their combined effect on the entire system is agent based simulation, in which individual personalities, behavioural patterns, decisions and the interactions of individuals are simulated simultaneously, their dynamic features are constructed and so the evolution of the entire society is observed and analysed. Using large capacity fast computers simulation studies can be repeated many times with many different variants, model parameter and environment selections.

Agent based simulation techniques have many applications in the social sciences, economics, politics, engineering, cognitive science among others. Their application area is expanding along the advance of computational power.

This special issue of IJIEM includes a selection of papers showing the broad field of applications of agent based simulation methodology.

Arianna Dal Forno and Ugo Merlone in their paper ‘Individual incentives in supervised work groups: from human subject experiments to agent based simulation’ examine some aspects of interaction between individuals in complex working environment and economic performance giving an insight in terms of observation of the performance measures and different incentive schemes.

Miklos N. Szilagyi in his paper ‘Cars or buses: computer simulation of a social and economic dilemma’ examines the dilemma of using cars or mass transportation in a large city. The simulation study is based on Pavlovian agents, when their decisions to cooperate (using public transportation) or to defect (using their own cars) accumulate over time to produce a resulting collective order that determines the success or failure of the transportation system. Situations are created in which an enormous majority of people prefer using mass transportation to driving cars.

Haiyan Qiao and Jerzy Rosenblit in their paper ‘Agent-based simulation in market and production system’ introduce a special learning process that can be used by competing firms to learn and approach the Nash bargaining solution in oligopolies. The theoretical method is illustrated by a simple example of three firms.

Miklos N. Szilagyi, Pick Chung Lau, Gavin Kumer and Ananda Krishan in the paper ‘Agent-based simulation of a simple market’ present on artificial society of sellers and buyers who’s payoffs are characterised by trade and price satisfaction functions. The participants are greedy, they try to follow the behaviour of those in their neighbourhoods that have received the highest payoff in the previous iteration. This results in trading, and transforming buyers into sellers and visa versa. Simulation study shows the evolution of this artificial society and illustrates how the ratio of buyers and sellers fluctuates around the equilibrium.

Erika Griechisch in her paper ‘A simulation study of public goods contributions’ examines an inter-group conflict in which agents (members of several groups) contribute to provide a public good to all of them and in the same time the groups compete for an external prize. A dynamic version of this game is analysed in which the agents may increase their contributions at any time depending on the condition that the additional contribution increases their payoffs or not. The dependence of the total contribution on the external prize and on the timing of the additional contributions is analysed. Simultaneous and cycles dynamics are considered in this paper.

Erika Griechisch and Ferenc Szidarovszky in their paper ‘A systematic approach of multi-person games’ present a systematic approach of a special group of multi-person games with linear payoff functions for the defectors and cooperators. Four parameters (the two intercepts of both payoffs) completely determine the game, so by fixing three parameters and gradually changing the fourth one the game envolves from battle of sexes to maximising differences through benevolent chicken and chicken games. The simulation study presents the varying characteristics of the different games as well as it shows how transitions are made from one game to another.

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