Nash equilibrium solution of fuzzy matrix game
solution of fuzzy bimatrix game

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ON THE NASH EQUILIBRIUM SOLUTION OF FUZZY BIMATRIX GAMES

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Abstract: In this paper, we propose a method for finding Nash equilibrium of fuzzy games. This method is based on ranking function of fuzzy linear programming which simplifies the solving process of fuzzy Nash equilibrium. Numerical results show that the proposed method is competitive to the state-of-the-art algorithms.

Keywords: Nash equilibrium, Fuzzy bimatrix game, Fuzzy two-person zero-sum games, Fuzzy linear programming, Ranking function, Fuzzy value.

\(\textbf{1. INTRODUCTION}\)

A game is a decision making system that involves more than one decision maker each having profits that conflict with each other. A strategic game first defines each player’s actions (strategy). The combination of all the players’ strategies will determine an outcome to the game and the payoffs to all players in which each player tries to maximize his own payoff. The traditional game theory assumes that all data of a game are known exactly by players [1]. However, in real games, the players are often not able to evaluate exactly the game due to lack of information, imprecision in the available information of the environment or the behavior of the other players. Initially, fuzzy sets were used by Butnariu [2, 3] in noncooperative game theory. He used fuzzy sets to represent the belief of each player for strategies of other players and introduced core and stable sets in fuzzy coalition games where a degree of participation of players in a coalition is assigned. Campos in [4] established the linear programming model to solve fuzzy matrix game. Sakawa and Nishizaki [5, 6] investigated single-objective and multi-objective games with fuzzy goals and fuzzy payoffs. They introduced a fuzzy goal for a payoff and assumed that every player tried to maximize his degree of attainment of the fuzzy goal. Then, the equilibrium solutions with respect to the degree of attainment of a fuzzy goal were defined. Finally, they transformed their models into a fractional programming problem and solved the fractional programming problem by a relaxed method.

Vijay, Hector and Chandra [7-9] proposed non-cooperative games in uncertainty based on the duality in fuzzy linear programming. They defined two types of solutions for the game and solved them by transforming the fuzzy dual problems into pairs of crisp dual problems. Kacher and Larbani [10,11] proposed a new class of games with fuzzy parameters involving two aspects: the game aspect and a decision making under uncertainty aspect. When the players choose their strategies, they must consider both the behavior of the other players and the possible realizations of the fuzzy parameter. Maeda [12] presented some kinds of equilibrium strategies for fuzzy matrix games based on specific symmetric triangular fuzzy numbers and investigated the existence conditions of equilibrium strategies for these models. Earlier work primarily fuzzified classic game from the following three aspects; (i) The policy is fuzzy, as the payment is clear; (ii) The payment is fuzzy, as the policy is clear; (iii) Both the policy and payment are fuzzy. There have been some researches on such problem. However, several problems existed within them. For example, the order relation between fuzzy numbers defined in [5] depends on the membership functions of fuzzy number. Because of ergodicity of \(\hat{e}\) in the membership function, this method is relatively difficult in actual calculations. The triangular fuzzy number is studied by using partial order relation between fuzzy numbers in [13]. This approach is not extensive enough as well as weak in distinguishing the partial order relation. This article focuses on the second class of fuzzy matrix game problem. In this paper we use ranking function and fuzzy linear programming for finding Nash equilibrium of fuzzy games.
3. CONCLUSIONS
In this paper, we studied Nash equilibrium solution to bimatrix games. Furthermore, we have proposed the new method for solving this problem. Our method is simple and graceful and the solving process here is much simpler than [4, 6, 12, 13].

REFERENCES
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