

A MINIMAX THEOREM FOR SET-VALUED MAPS AND ITS APPLICATION TO MULTI-OBJECTIVE UNCERTAINTY

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In this presentation, we propose two-person games with set payoffs. Then we introduce several concepts of saddle points and equilibrium points of two-person games with set payoffs. We also present an existence theorem of saddle-point by using Kakutani-Glicksberg-Fan's fixed point theorem[5]. We also present a new type minimax theorem for set-valued maps[1]. The proposed theory described above can be interpreted as uncertain multi-objective game theory. We also formulate an uncertain multi-objective game.

REFERENCES

- [1] Y. Araya, M. Kon, Y. Kimura, *A minimax theorem for set-valued maps and its application to multi-objective uncertainty*, submitted to J. Oper. Res. Soc. Japan.
- [2] J. P. Aubin, H. Frankowska, *Set-valued analysis* (Systems & Control: Foundations & Applications, 2. Birkhäuser Boston, Inc., Boston, MA, 1990).
- [3] A. Hamel, A. Löhne: A set optimization approach to zero-sum matrix games with multi-dimensional payoffs. *Mathematical Methods of Operations Research*, **88** (2018), no.3, 369–397.
- [4] J. Ide, A. Schöbel: Robustness for uncertain multi-objective optimization: a survey and analysis of different concepts. *OR Spectrum*, **38** (2016), 235–271.
- [5] S. Kakutani: A generalization of Brouwer's fixed point theorem. *Duke Mathematical Journal*, **8** (1941), 457–459.
- [6] D. Kuroiwa, T. Tanaka, T. X. D. Ha: On cone convexity of set-valued maps. *Nonlinear Analysis*, **30** (1997), 1487–1496.
- [7] J. von Neumann, O. Morgenstern: *Theory of games and economic behavior* (Princeton University Press, Princeton, NJ, USA, 1944).
- [8] J. W. Nieuwenhuis: Some minimax theorems in vector-valued functions. *Journal of Optimization Theory and Applications*, **40** (1983), no.3, 463–475.
- [9] T. Tanaka: Generalized quasiconvexities, cone saddle points, and minimax theorem for vector-valued functions. *Journal of Optimization Theory and Applications*, **8** (1994), no. 2, 355–377.

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