Dependence of Nash Equilibria on Incompetence

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Abstract

There are many application areas for game theory where it is desirable to analyse the behaviour of the game as the game itself changes. For example in the training of sports people, we can examine how the strategies and pay-offs for the player change as their skills increase. Also, in new equipment purchase for defence forces, a key problem is to examine how pay-offs and strategies change as new capabilities are purchased, often for vast amounts of money.

These problems are being addressed through introducing the notion of incompetence to standard non-cooperative games. Incompetence represents the concept that the action desired by a player might not always be the action that they are able to execute. For instance, tennis players who desire to serve aces may instead serve faults due to their inability to always execute their chosen action. Incompetence is represented by an incompetence matrix which maps how the desired actions translate to actual outcomes.

This concept was first introduced in [1] and discussed specifically in the case of zero-sum matrix games. The present paper derives the results for bimatrix games.

In this paper we describe how incompetence is introduced into bimatrix games and demonstrates the results in some simple examples. These examples demonstrate that the number of equilibria can change as the level of capability or training changes along with other properties. Identification of critical levels of training where changes occur now emerges as a challenging problem in the theory of games with incompetent players. Larger examples follow to demonstrate some of the more complex behaviours that are possible. Finally, several analytic results are presented, which have parallels to the results presented in the zero-sum case.

References

[1] J Beck and J Filar Games, Incompetence and Training. *Annals of ISDG, vol 8*, Eds: Steffen Jørgensen and Thomas Vincent and Marc Quincampoix, Boston, USA, Birkhäuser, pp 93-110 2007.