Mathematics > Probability

A discrete dynamical system for the short-range optimization strategy at collective Parrondo games

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We consider a collective version of Parrondo's games with probabilities parametrized by rho in (0,1) in which a fraction phi in (0,1] of an infinite number of players collectively choose and individually play at each turn the game that yields the maximum average profit at that turn. Din\'is and Parrondo (2003) and Van den Broeck and Cleuren (2004) studied the asymptotic behavior of this short-range optimization strategy, which corresponds to a piecewise-linear discrete dynamical system in a subset of the plane, for rho=1/3 and three choices of phi. We study its asymptotic behavior for all (rho,phi) in (0,1)x(0,1], finding that there is a globally asymptotically stable equilibrium if phi<=2/3 and, typically, a unique asymptotically stable limit cycle if phi>2/3 ("typically" because there are rare cases with two limit cycles). Results for phi>2/3 are partly conjectural.

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