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# Fixation probabilities of mixed-strategies for bimatrix games in finite populations

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Stochastic evolutionary game dynamics in finite populations has recently been examined not only for symmetric games [1] but also for bimatrix games [2]. While in these studies the fixation probabilities of pure strategies are investigated, this study examines the evolutionary dynamics of two-player 2 by 2 bimatrix games with mixed-strategies in finite populations under weak selection. The game has two populations for row and column players. In the population consisting of row (column) players, two types of players, i.e., mutant and wild-type players, have different mixed-strategies which assign different weight to the two row (column) strategies. Each player's fecundity is determined by the average payoff obtained by interactions with all players in the opposite population. The process of death and birth of players is modelled by the frequency-dependent Moran process.

For this game, I derived the fixation probabilities that a pair of mixed-strategies by mutants in the row and column populations takes over the entire populations from a given initial state. Moreover, based on the probabilities, I discuss the stochastic stability of the pair of mixed-strategies played by wild-type players.

In addition, the fixation probabilities of mixed-strategies of mutant players when the selection is weak because of mixed-strategies played by mutant and wild-type players being very close in terms of a probability distribution over the set of possible strategies, which are the counterparts of Wild and Traulsen [3] in bimatrix games, are also discussed.

[1] Nowak, M. A., Sasaki, A., Taylor, C., & Fudenberg, D. (2004). Emergence of cooperation and evolutionary stability in finite populations. *Nature*, 428(6983), 646.
[2] Sekiguchi, T., & Ohtsuki, H. (2017). Fixation probabilities of strategies for bimatrix games in finite populations. *Dynamic Games and Applications*, 7(1), 93-111.
[3] Wild, G., & Traulsen, A. (2007). The different limits of weak selection and the evolutionary dynamics of finite populations. *Journal of Theoretical Biology*, 247(2), 382-390.

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