

Philosophy 3334: Philosophy of Biology  
Spring 2018  
Third short assignment

This assignment is due on Tuesday, March 6th

1) Imagine the following scenario: Individuals within a population are paired up with each other into groups of two. Assume there is a default fitness of two for each player. Each player has the option of either doing nothing or of doing an action that costs themselves one unit of fitness but that benefits their partner increasing their partner's fitness by four.

**Problem:**

**1a)** Label the two strategies "donate" and "nothing" and draw up a 2x2 payoff matrix (like my matrix on problem 1 of the second assignment) and fill in the payoffs of the four cells.

**1b)** Assume that players in the population meet at random and play this game one time. Which strategies are ESSs in this game? (the answer could be either one of them, both, or neither). Explain why.

**Problem:**

If you think about Dawkins' definition of altruism in terms of outcomes (ignoring motivations) you will see that "donate" counts as an altruistic strategy. So it would seem that it is impossible for donate to evolve in a natural game like this. But it is possible in two different scenarios.

**1c)** If the pairing of players is not random, then it is possible for donate to evolve by kin selection. What would the average  $r$  (relatedness coefficient) between partners have to be in order for donate to evolve by natural selection? Explain your answer.

**1d)** Assume that the pairing stays random but that they play the game three times against the same partner before reproducing. Now there are numerous "conditional" strategies in the population. We will consider "nothing" to mean do not donate on any round. "Donate" means you donate on every round. "tit-for-tat" means you donate on the first round and then on every subsequent round do what your partner did on the previous round. Create a 3x3 table that shows the payoffs for each of the nine possible pairings in this game.

**1e)** What are the ESSs in this game? Show your work.

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**2)** Dawkins defines a meme to be a unit of cultural transmission. Can memes be subject to natural selection in the same way that genes are? Does the science of “memetics” just look like the theory of biological evolution? Give some reasons to think that we can study cultural evolution in this way and also discuss some of the differences between biology and culture which might undermine the analogy. Either explain why you think some of these differences make it inappropriate to talk about natural selection in this way or explain why you think that you can still talk about cultural selection despite these differences. It would probably be helpful to think about a particular case such as the spread of a particular song or a spread of the idea of God.