Philosophy 3334: Philosophy of Biology
Summer 2018
Second homework

This assignment is due on Monday, June 18th

1) Lets say that "siblings" refers to just any young animals raised together when they are still somewhat dependent on at least one adult to keep them alive. Some social behaviors between siblings we can call "sibling rivalry" where they one sibling harms another (sometimes even killing each other) and other behaviors are cooperative. Animal species exhibit a huge variety of types of family structures. Here are some possibilities: In species A children are born one at a time and raised by their mother. The species is like humans – many siblings have the same father but not all. Species B is like A except it is strictly monogamous. All siblings have the same father. Species C is like A except they aren't born one at a time but rather in litters like dogs. Recall that puppies in the same litter sometimes have the same father but do not always. Species D is like A except they are raised in groups by multiple mothers who collectively take care of all of the groups' children. Which, if any, of these changes do you expect would increase sibling rivalry? Which would increase cooperation? Explain why.

2) Across the animal kingdom (ignoring the social insects) do males or females tend to have more children on average? Why? Do males or females tend to have a higher variance in the number of offspring they have? (A higher variance means a wider "spread" so that they are more likely to have more or less than the average). Why?

3) Imagine a species of bird which gets parasites on its head that the individual with the parasite can't remove, but that other birds could remove. We will assume that each interaction follows the following payoff matrix.

	Groomer	Non-Groomer
Groomer	8,8	1,9
Non-Groomer	9,1	2,2

3a) 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 "Groomer" counts as an altruistic strategy. So it would seem that it is impossible for grooming to evolve in a natural game like this. But it is possible in two different scenarios.

3b) If the pairing of players is not random, then it is possible for grooming to evolve by kin selection. What would the average r (relatedness coefficient) between partners have to be in order for grooming to evolve by natural selection? Explain your answer. HINT: You can do this by calculating the inclusive fitness of each of the strategies (the payoff to you plus the payoff to your partner weighted by how closely related they are to you) or by using Hamilton's rule (the benefit is how much better off the recipient of the altruism is than they would otherwise be and the cost is how much worse off the altruistic actor is than they would otherwise be).

3c) Assume that the pairing stays random but that they play the game three times against the same partner before reproducing. Now there are numerous possible strategies including "conditional" strategies in the game. We will consider four of them: "Groomer" means you groom your partner on every round no matter what. "Non-Groomer" means you never groom your partner. "tit-for-tat" means you groom on the first round and then on every subsequent round do what your partner did on the previous round. "Odd" means you groom on the first and third rounds (the odd numbered rounds) and do not groom on the second round. Create a 4x4 table that shows the payoffs for each of the sixteen possible pairings in this game.

4) 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.

5) Recall that in the preface, Dawkins said, "We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes." Throughout the book, Dawkins gave a number of examples of animal behavior that seems to show that this is at least a sometimes helpful way to think about biology. But is it a helpful way to think about humans? In what sense is this sentence true or false? Does it reflect something true enough and important enough that we can learn a lot about ourselves by thinking about the history of our genes? Or perhaps we are so much more or there is something so special about us that it is seriously misleading or even straightforwardly false that we are survival machines built by our genes? Or some other alternative?

I expect a thoughtful response to this question. An answer of roughly 200-400 words or so would be appropriate.