Philosophy 3334: Philosophy of Biology
Spring 2020
Second assignment

Please print your answers and bring them to class on Thursday, Feb 20th. **ALSO** please make your assignment anonymous by putting your R# at the top of the page and **NOT** your name.

1) Imagine the following scenario: A species of carnivore is such that there are two different hunting strategies in the population. Strategy 1 is to pursue the 'group hunt' strategy of attacking big game, which is only successful with help. Strategy two is to pursue the 'lone wolf' strategy of hunting smaller game, which is always successful. When the time comes to get food, the hunters find themselves nearby another hunter. If a 'group hunter' meets another 'group hunter' they each receive 4 units of benefit. 'Lone wolf' always receives 2 units of benefit no matter who they meet. But if a 'group hunter' meets a 'lone wolf', then 'group hunter' gets 0 benefit while 'lone wolf' gets 2.

In other words, we have the following payoff matrix:

	Group hunter	Lone wolf
Group hunter	4,4	0,2
Lone wolf	2,0	2,2

Which of these two strategies, if any, is an evolutionarily stable strategy? Explain how you know.

2) Imagine a two-player game where individuals in the population are paired at random. There are two possible strategies: heads and tails. If both players play heads or both players play tails, then nobody gets any payoff. However, if a head is paired against a tail, then the head receives 4 units of payoff and the tail receives 6. In other words, we have the following payoff matrix:

	Heads	Tails
Heads	0,0	4,6
Tails	6,4	0,0

In fact, neither heads nor tails is an evolutionarily stable strategy.

2a) Explain why neither state is stable.

2b) Now imagine that the population is 80% heads and individuals are paired at random. What is the expected payoff of the heads strategy? And what is the expected payoff of the tails strategy?

2c) Assuming that the payoffs represents reproductive fitness, over time, this population will reach a stable state. What is the percentage of heads and tails in this stable state? Show your work and explain how you know this state is stable.

3) What would be the coefficient of relatedness between me and my mother's half-sister? (Half-siblings share one parent but not both). Explain your answer.

4) In each of these two following scenarios, explain which trait will be favored by natural selection and why. If you think particular numbers do or do not matter, your answer should explain why they do or do not matter (in other words, show your work).

4a) Organisms of species Alpha typically find themselves in groups of size 5 on average. Organisms in this species leave their homes soon after they are born and so are no more likely to be nearby kin than nearby more unrelated organisms. When a predator attacks, there are two possible strategies: Strategy A is to simply run away. If you do so, the chance of being killed yourself is 5% and the chance of some other member of your group being killed is 80%. There is a 15% chance you will all get away. Strategy B is to send up an alarm call warning everyone in your group. The chance of being killed yourself is now 10% but there is only a 40% chance of someone else in your group being killed and a 50% chance that you will all get away. Will natural selection favor strategy A or strategy B?

4b) Organisms of species Beta live in family units consisting of a mother and all her children who always share the same father. Sometimes there are 2 children, sometimes 3, sometimes 7, etc. On average, the group consists of 5 individuals. When a predator attacks, there are two possible strategies: Strategy A is to simply run away. If you do so, the chance of being killed yourself is 5% and the chance of some other member of your group being killed is 80%. There is a 15% chance you will all get away. Strategy B is to send up an alarm call warning everyone in your group. The chance of being killed yourself is now 10% but there is only a 40% chance of someone else in your group being killed and a 50% chance that you will all get away. Will natural selection favor strategy A or strategy B?

5) 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. Remember that puppies in the same litter sometimes have the same father but do not always. It is the same way in species C. 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. (So compare ALL of A-D that you can).

6) 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?