BIOL 01104 Fall 2019
Fitness, Selection, and Hardy Weinberg Equilibrium Assignment
Instructor: Dr. Spielman
Due Wednesday 10/23/19 in class, stapled

Name:_____

Names of any students you completed assignment with:

Instructions:
Complete each question *by hand on this paper*, showing all of your work. **Clearly indicate your final answer by circling it** (including conclusions, when applicable). Please directly hand in this sheet with your work and answers in the spaces provided.

1. You are studying differences in whisker length in a population of manatees in the Gulf of Mexico. This trait shows *incomplete dominance*, where **WW**=long whiskers, **Ww**=intermediate whiskers, and **ww**=short whiskers. You have found, in a population of 75 manatees, that 40 have long whiskers, 10 have intermediate whiskers, and the remaining 25 have short whiskers. Determine if this population of manatees is in Hardy-Weinberg equilibrium or if there is evidence of evolution. Your answer should provide an approximate *P-value* and a final conclusion in the form of a sentence.

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2. You are studying a population of crocodiles with variation in their teeth characteristics. You find that genotype **SS** individuals have long but dull teeth, genotype **Ss** individuals have average-sized teeth, and genotype **ss** individuals have small but extremely pointy teeth. In a population of 60 crocodiles, 32% of individuals are SS, 58% of individuals are Ss, and 10% of individuals are ss. Determine if this population of manatees is in Hardy-Weinberg equilibrium or if there is evidence of evolution. Your answer should provide an approximate *P-value* and a final conclusion in the form of a sentence.

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3. You decide to set up an assay to compare fitnesses of the different crocodile genotypes/phenotypes from the previous question. You randomly select 20 individuals with each tooth phenotype, and you give each individual a live chicken to eat. You measure fitness by asking how much of the chicken was eaten after an hour, under the assumption that the rate of consumption is a proxy for fitness. You found these results, on average:
   - SS (long teeth) consumed 70% of the chicken
   - Ss (average teeth) consumed 50% of the chicken
   - ss (small teeth) consumed 30% of the chicken

Assuming "percent of chicken eaten" is a proxy for fitness, calculate the following quantities in the space provided:

- The relative fitness for each genotype.

- The selection coefficients for each genotype.

- Considering the values calculated above, what would be the <u>mean fitness</u> of a population of 50 crocodiles, where 25% have long teeth, 28% have average-sized teeth, and 47% have short teeth.

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4. A species of mice has two color phenotypes: dark fur (genotypes **PP** or **Pp**) or light fur (**pp**). You are studying a population of 200 mice that is known to be in Hardy Weinberg equilibrium. Of these 200, you determined that 125 have a genotype of PP.

a. Determine the *number of mice* from population that have each of the other genotypes, Pp and pp. [Hint: The frequency of PP individuals corresponds to the p^2 quantity in Hardy Weinberg calculations. You can use this value to determine p and q, from which you can calculate the number of individuals for the other genotypes.]

b. Assume the relative fitness of dark-colored mice kernels is 1.0, and the relative fitness of light-colored mice is 0.78. Calculate the mean fitness of this population of mice.