Assignment: Alleles, Genotypes, and Hardy Weinberg Equilibrium
Introduction to Evolution and Scientific Inquiry, Fall 2018
Instructor: Dr. Spielman

Name:_____

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). This assignment is due Monday 10/15/18 at the beginning of class. Please directly hand in this sheet with your work and answers in the spaces provided.

Question 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 45 have long whiskers, 7 have intermediate whiskers, and the remaining 23 have short whiskers.

a. If natural selection is responsible for this distribution of whiskers in the manatees, which *mode* of selection do you think is acting? Why? Write 1-2 sentences for this answer.

b. Determine if this population of manatees is in Hardy-Weinberg equilibrium or if there is evidence of evolution. You must ultimately calculate a p-value *and* state your final conclusion in the form of a sentence.

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Question 2

You are studying a population of "rodents of unusual size" (ROUS's) in the Fire Swamp, specifically their teeth characteristics. You find that genotype **SS** individuals have pointy teeth, genotype **Ss** individuals have serrated teeth, and genotype **ss** individuals have no teeth but jaws strong enough to crush you (either way, don't get bitten). In a population of 60 ROUS's, 30% of individuals are SS, 60% of individuals are Ss, and 10% of individuals are ss.

a. If natural selection is responsible for this distribution of teeth types in ROUS's, which *mode* of selection do you think is acting? Why? Write 1-2 sentences for this answer.

b. Determine if this population of ROUS's is in Hardy-Weinberg equilibrium or if there is evidence of evolution. You must ultimately calculate a p-value *and* state your final conclusion in the form of a sentence.

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Question 3

Intrigued by the bizarre teeth styles of ROUS's, you decide to set up an assay to compare fitnesses of the different genotypes/phenotypes. You randomly select 20 individuals with each tooth phenotype, and you give each ROUS (they are vicious carnivores!) a small goat to eat. You measure fitness by asking how quickly each ROUS fully devours the goat. You assume that individuals who are able to consume their food the fastest have the highest fitness. You found these results, on average:

- SS (pointy teeth) take an average 355 seconds to eat the goat
- Ss (serrated teeth) take an average 315 seconds to eat the goat
- ss (no teeth but strong jaws) take an average 410 seconds to eat the goat

Assuming "time to eat" is a proxy for fitness, calculate the following quantities:

1. The relative fitness for each genotype
2. The selection coefficients for each genotype
3. The mean fitness of the population

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Question 4

Corn kernels can be either purple (**PP** or **Pp**) or yellow (**pp**). A random sample of 750 corn kernel was sampled from a field of corn known to be in Hardy-Weinberg Equilibrium. Of these 750, you determined that 244 have a genotype of PP.

a. Determine the *number of kernels* from this sample that have genotypes Pp and pp.

b. Assume the relative fitness of purple kernels is 0.82, and the relative fitness of yellow kernels is 1.0. Calculate the mean fitness of your sample of kernels.

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