Print your name + UIN:_____

BIOS 230-Fall 2017
Problem Set #1 - 45 pts.
Due Thursday, September 28, 2017
No late homework accepted!
Show your work for full credit.

The body color of a certain species of fruit fly is determined by one gene with two alleles, B (black) and b (yellow). In a population of 500 fruit flies, you see the following phenotypes:

BB	Black body color	41
Bb	Brown body color	133
bb	Yellow body color	326

1. **Calculate the allele frequencies of B. (3 pts.)**

2. **Calculate the allele frequencies of b. (3 pts.)**

Melanism (black fur) in squirrels is caused by a deletion mutation in the MC1R allele. Individuals with a homozygous recessive allele combination appear to have a darker coat color. A population in Montreal had 37 melanistic individuals and 38 normal squirrels. The population in Toronto had 249 melanistic individuals and 0 normally colored squirrels.

What is the frequency of the melanistic allele in each population? Show your work. Calculate your answer to 4 decimal places.

3. **Frequency of melanistic allele in Montreal pop: (3 pts.)**

4. **Frequency of melanistic allele in Toronto pop: (3 pts.)**

Tay-Sachs disease is caused by receiving two copies of a recessive allele at the HEXA gene locus. Mutations in the HEXA gene disrupt the activity of an enzyme called beta-hexosaminidase A, preventing it from breaking down a fatty substance known as GM2 ganglioside. GM2 ganglioside then accumulates to toxic levels in the neurons located in the brain and spinal cord. One in 800 people of Ashkenazi Jewish descent inherit this disease. One in 42,700 French-Canadians also inherit the disease. Calculate the frequency of the sickle cell allele in these two populations. Take your answer out to 4 decimal points. Show your work.

5. **What is the frequency of the Tay-Sachs allele in the Ashkenazi Jewish population? (3 pts.)**

6. **What is the frequency of the Tay-Sachs allele in the French-Canadian population? (3 pts.)**

7. **What percentage of people of Ashkenazi Jewish heritage will be carriers of the trait, but not have the disease? (3 pts.)**

8. **What percentage of French-Canadians will be carriers of the trait, but not have the disease? (3 pts.)**

Tongue rolling is a common trait that allows people to roll the lateral edges of their tongue upwards into a tube. The ability to roll your tongue is controlled by a dominant allele. In the overall population, 68% can roll their tongues, and 32% cannot. Estimate the allele and genotype frequencies of the tongue-rolling (T) and non-tongue-rolling (t) allele in this population. Show your work and carry to 4 decimal places.

9. What is the frequency of the t-allele? (3 pts.)

10. What is the frequency of the T-allele? (3 pts.)

11. What percentage of people is heterozygous for the tongue-rolling allele? (3 pts.)

We want to determine whether time to sexual maturity (egg laying) in salmon is a heritable trait. A population of 200 salmon takes an average time of 147 days to reach maturity. We select 15 salmon that reached maturity earliest; their average time to adulthood is 113 days. We breed those 10 early-adult chickens with each other and monitor the resulting chicks. We watch to see when they mature; the average time to maturity is 125 days.

12. Calculate the selection differential. (3 pts.)

13. Calculate the response to selection. (3 pts.)

14. Calculate heritability (h^2). (3 pts.)

15. Interpret the heritability of maturity in chickens from above. (3 pts.)