**Mendelian Genetics Assignment (10%)**

1) "a" is a dominant mutant allele of the A gene, and "b" is the recessive mutant allele of the B gene. To see the mutant phenotype, one requires either an "a" mutant phenotype or a "b" mutant phenotype (both mutations are not necessary).
What would the F2 segregation ratio be (wild type to mutant) of the cross of an aabb mutant with AABB wild type?  1 mark

2) How many wrinkled yellow peas do you expect to get from a cross between two green, round pea plants that are heterozygous? Green is dominant to yellow and round is dominant to wrinkled. 0.5 marks

3) You hypothesize that you have one autosomal dominant trait. You crossed the following true breeding parents: wild type female and mutant male. In the F2 generation you observe the following phenotypes: 35 dominant females, 35 dominant males, 20 recessive males, and ten recessive females. Show your square calculations, and does this fail to reject the stated hypothesis? (1 pt) 1 mark

4) What is the genotypic ratio of the progeny produced from this mating: Parental cross - female aaBb crossed with a male AABb? 0.5 marks

5) You are studying hair length in wild yaks and perform the standard genetic crosses. From the following observations provide a hypothesis of how this trait is inherited (which allele is dominant and whether it is autosomal or sex-linked). Assume both parents are true breeding. Test your hypothesis with a square test. Show all your calculations for the Square.
P: short haired male X long haired female
F1: 145 long haired males  and 155 short haired females
(F2 is a cross of F1 male and female)
F2: 73 long haired females; 77 short haired females; 72 long haired males, 78 short haired males. 2 marks Bonus

6) You are analyzing a dihybrid cross where both mutant traits are autosomal recessive in a Scooby Doo species. You set up the cross with each true breeding parent exhibiting one wild type trait. You observe A = brown, a = gray and M = munchies, m = no munchies. In the F2 generation you observe 152 brown munchie having scoobys, 48 brown no munchie having scoobys, 42 grey munchie having scoobys and 12 grey no munchie having scoobys. 2 marks
a. Draw the Punnett squares for F1and F2.
b. What is the expected number of each F2 phenotype (show work)
c. Does Chi-square support the null hypothesis? (show your work)

7) Assume that "S" represents the dominant trait of having long leaves, and "s" represents the recessive short-leafed trait in a plant. In the parental generation, you cross a homozygous long-leafed plant with a homozygous short-leafed plant. 2 marks
a. Draw a Punnett square illustrating this cross, and give the genotypes and phenotypes of the F1 generation.
b. Using a Punnett square, show the genotypes and phenotypes of the F2
generation if the F1 plants in question 1 are self-fertilized.
c. In question 2, what is the probability that the F2 plants will have short
leaves?

8) You were thrilled to have a new baby sister, but excitement turned to anxiety when she began to have digestive problems with persistent vomiting. Doctors quickly learned that she had an autosomal recessive disorder called galactosemia. Your sister lacked the enzyme that breaks down the milk sugar galatose, so her pediatrician put her on a special diet free of lactose and galactose. In a short time, your sister was fine. 3 marks
a. Neither of your parents is affected with galactosemia. If your
sister's genotype is gl/gl, what are your parents' genotypes?
b. You are not affected with galactosemia. What is your genotype or
possible genotypes?
c. Will your sister automatically pass on this disease to her children? Why or why not?