

Genetics 320, Problem Set 9 (10 points)

Due Wes, 23 November at 11 am

1 (2 points): Consider a cross between an M_2M_3 father and a M_2M_4 mother. In the offspring, the marker genotype is scored, along with nose length and the following data are observed.

Genotype	Mean nose length
M_2M_2	100
M_2M_3	100
M_2M_4	300
M_3M_4	300

- (a) Is there evidence that the marker is linked to a segregating QTL for nose length in the father?
- (b) Is there evidence that the marker is linked to a segregating QTL for nose length in the mother?

2 (2 points): Consider a locus with four alleles (A_1 to A_4) at the following frequencies: $p_1 = 0.1$, $p_2 = 0.2$, $p_3 = 0.3$, $p_4 = 0.4$. Assume random mating and all other Hardy-Weinberg conditions. What is the frequency of

- (a) A_2A_3 ?
- (b) A_4A_4 ?
- (c) All heterozygotes involving allele A_2 ?
- (d) All heterozygotes?
- (e) Of a mating between A_1A_2 and A_3A_3 parents.

3 (2 points): This problem examines what happens when there are different allele frequencies in the two sexes (as would occur if one mates males from one population with females from a second). Assume an autosomal locus, where the frequency of allele A in the male and female founding populations is p and r , respectively. Assuming all other Hardy-Weinberg conditions hold,

- (a) What is the frequency of AA homozygotes in their offspring?
- (b) What is the frequency of A - heterozygotes?
- (c) What is the frequency of allele A in their male offspring? In their female offspring?
- (a) What happens to the allele and genotype frequencies in subsequent generations?

4 (2 points): Consider alleles A and B at linked loci (with $c = 0.2$). Suppose $D_{AB} = 0.1$, $\text{freq}(A) = 0.4$, $\text{freq}(B) = 0.5$.

- (a) What is $\text{freq}(AB)$?
- (b) After ten generations of recombination, what is $\text{freq}(AB)$?

5 (2 points): Consider the M/N , S/s blood group data from the Ugandan population in the Table in lecture 43. Suppose the recombination frequency between these two loci is $c = 0.05$.

- (a) If these gametes combine at random, what is the frequency of MM individuals? Of Ss individuals? Of $MMSs$ individuals?
- (b) For these gamete frequencies, what is the disequilibrium (if any) for MS gametes? For Ms gametes?

- (c) After ten generations of random mating, what is the expected disequilibrium for MS gametes? For M_s gametes?
- (c) After ten generations of random mating, what is the expected frequency of MMS_s individuals?