

Homework Assignment #3

Date Assigned: 20 October 2010.

Date Due: 28 October 2010.

1. With three alleles, find a set of allele frequencies in two populations which give *more* heterozygotes than expected under HW proportions for at least one of the heterozygous genotypes, if we sample from a mixture of the two populations.
2. Assume two populations, each in linkage equilibrium. Can the process of mixture (migration) create linkage disequilibrium? If so, give an example of two such populations and show that a mixture of these, in equal proportions, will have LD. If not, prove your answer.
3. Suppose we create a mixture population S from n populations, where a fraction m_i of the individuals in S come from population i (for $1 \leq i \leq n$). What is the amount of LD in the mixture population in terms of the D parameter?
4. When linkage disequilibrium is created by an initial admixture of two populations, each in linkage equilibrium, but with both loci having different allele frequencies in the two populations, what will be the formula for the decay of D with time?
5. Can you construct a case with two populations exchanging migrants at a constant rate, in which the allele frequency in a population oscillates and never settles down to an equilibrium? Can you construct a case with two populations exchanging migrants at a constant rate, in which the allele frequency in a population oscillates and ultimately settles down to an equilibrium?
6. In a two-island model with immigration rates 0.1 and 0.2 into the islands, whose initial frequencies of an allele are respectively 0 and 1, what will be the equilibrium allele frequency?
7. Suppose we have two continents, one with allele frequency of 1.0 for allele A, and the other with allele frequency of 0. Between them stretch a chain of d islands that form a perfect stepping stone model, with migration rate $m/2$ between adjacent islands, and migration rate $m/2$ into each of the terminal islands from the nearby continents. What is the equilibrium array of allele frequencies in the islands?