

Population Genetics
Problem Set 7

1. Consider a rare population where the effective population size equals the census size and is 40. Assume no selection or migration.

a. How long is it expected to take on average for a new neutral mutant allele to become fixed in this population?

b. For a new neutral mutation in this population, what is the probability that it will become fixed in the population?

c. If the new neutral mutant allele is one of only two alleles in the locus for this population, what is the probability that the original allele will become fixed?

2. Assuming neutrality for all markers, and similar reproductive success for males and females, for a small population, to what relative degree will each of the following genetic markers be affected by genetic drift? Why?

Markers: autosomal, mitochondrial, X-chromosome, Y-chromosome

3. What are the arithmetic mean and the harmonic mean of the following numbers: 2000, 300, 100

4. Two populations are similar except in terms of inbreeding coefficient. The first population has no inbreeding, while the second population has an inbreeding coefficient of $f = 0.1$. The first population has an effective population size of 110. What is the effective population size of the second population?

5. What factors determine the probability of fixation for an allele subject to selection, in a finite population?

6 Give the best definition for the following terms:

a. Bottleneck:

b. Founder effect:

c. Genetic drift:

d. Absorbing states:

e. Mutation:

f. Frameshift mutant:

g. Gene conversion:

h. Mutation-selection balance:

7. What may cause hybrid dysgenesis, i.e., sterility when two different strains of *Drosophila* are crossed?

8. Why is the hypothetical fitness curve of mutations said to be bimodal?

9. What are two major components of **genetic load**?