Name:

BIOL415 Quiz #1:

1. An isolated population of *Drosera rotundifolia* has recently lost a self-incompatibility system that prevents mating with close relatives, and now preferentially selfs. In one sentence, how is the genetic structure of the population likely to change? [1]

Model answer: This population is likely to have **increased homozygosity** as the result of this newly evolved capacity to self.

1 pt for describing the increase in homozygosity or decrease in heterozygosity

2. Explain in your own words why the strength of genetic drift varies with effective population size (1–2 sentences). [2]

Model answer: Genetic drift is the result of **random sub-sampling** in finite populations. The strength of any particular random event is likely to **be stronger in smaller populations** because, for example, the loss of one allele will have a higher magnitude effect on a population containing 20 allele copies (1/20 loss) than on a population containing 200 allele copies (1/200 loss).

0.5 pts for defining (or correctly using in context) genetic drift and 0.5 pts for identifying that it is stronger in small populations
1 pt for any logical, coherent explanation of why

3. You are designing a study to obtain long-term estimates of gene flow between two populations of *Pinus longaeva*. Describe in 1–2 sentences the method you will use, including why you chose it and any possible caveats. [2]

Model answer: I would choose an **indirect method** to estimate gene flow by calculating the number of migrants per generation (**Nm**) from estimates of population genetic differentiation (**Fst**) under the island model. This method gives estimates of **historical gene flow**, but might not be accurate if the populations **differ from the assumptions of the island model** (for example if they have experienced selection).

0.5 pts for choosing indirect method/estimating Nm and 0.5 pts for description of how Nm is estimated
0.5 pts for why: historical/long-term estimate and 0.5 for caveat(s), several possible

Up to 1 pt for describing a valid direct method instead

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4. Koa (*Acacia koa*) is an endemic tree, found on all eight main Hawaiian Islands. A conservation team sent you ten individual leaf samples of Koa from each island (8 islands in Hawaii -> 80 samples total). They asked you to study the phylogeography of the species.
    a. What is a phylogeographic question you could ask with these samples? 1 sentence [1]
    b. What method would you use to answer this question? 1-2 sentences [1]

Model answer:

Question1. What are the primary factors of shaping genetic structure and phylogeographic patterns of Koa in Hawaii?
Question2. How important is the geographic isolation (between islands) to population divergence?
I would genotype all 80 samples using a few chloroplast markers and generate the haplotype network to find out where Koa originated and where it colonized to by comparing with the geographic distributions.

1pt for a logical phylogeographic question of the study
1pt for choosing methods and techniques to answer the question