**Biology 180 Practice Exam 1 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Spring 2015**

**Question 1 2 points**

You survey a population of twinflower plants and find that genotypes at the R gene have the following frequencies (the three alleles involved are R1, R2, and R3):

R1R1: 0.15

R1R2: 0.10

R2R2: 0.20

R2R3: 0.20

R1R3: 0.10

R3R3: 0.25

Are the genotype frequencies in Hardy-Weinberg proportions? (Assume yes if all of the observed frequencies are within 3% (0.03) of the expected frequencies; otherwise no) If so, explain what this means. If not, explain the nature of the discrepancy between observed and expected.

Sample answer:

No—they are not. There are FAR too many homozygotes observed (and/or FAR too few heterozygotes observed), compared to the frequencies expected under H-W.

Rubric:

For full credit (2 points), the answer must be “no” and the explanation must be correct.

Award partial credit (1 point) if the answer is “no” but the explanation is not correct.

Award no credit (0 points) if the answer is yes.

**Question 2 2 points**

Using your data on twinflower plants, and using the Hardy-Wienberg model as the null hypothesis, you perform a statistical test and get a p-value of 0.07. What does this p-value represent?

Sample answer:

If the Hardy-Weinberg model was correct, we would expect to see genotype frequencies as weird as the ones we observed 7% of the time.

The probability of getting results as unexpected as the data we observed is 0.07, under the Hardy-Weinberg hypothesis.

Rubric:

For full credit (2 points) the answer must articulate that the p-value is (1) the probability of (or how often we expect to see) data like ours, (2) when assuming the Hardy-Weinberg hypothesis is correct.

Partial credit (1 point) if the answer only articulates one of the two components that are necessary for full credit.

Award no credit (0 points) if neither component is clearly stated.

**Question 3 2 points**

Last week in class, we talked about two species of flowers, *Mimulus lewisii* and *M. cardinalis*, that are primarily pollinated by bumblebees and hummingbirds, respectively. If bumblebees go extinct, and *M. lewisii* have to rely on hummingbirds for pollination, what mode of selection would *M. lewisii* most likely experience and why?

Sample answer:

Directional selection, because *M. lewisii* would be under strong selection for flower phenotype (color and shape) that is conducive to hummingbird pollination.

Rubric answer:

For full credit (2 points), the answer must be “directional selection,” and the explanation must be correct. Note, it is ok if the explanation mentions particular flower phenotypes that increase hummingbird pollination (like red coloration and no “landing platform”).

Award partial credit (1 point) if the answer is “directional selection,” but the explanation is not correct.

Award no credit (0 points) if the answer is not “directional selection.”

**Question 4 2 points**

Most tropical bird species breed seasonally. It seems like individuals that bred all year would have higher fitness, so why don't more species breed year round?

Sample answer:

Developing, laying, and caring for eggs requires a lot of energy, and individuals have access to finite resources. Thus, reproducing constantly would create a fitness trade-off, like dying young.

Rubric:

For full credit (2 points) the answer must state that finite (limited) resources limit how much energy can be allocated to reproduction.

Award partial credit (1 point) if the answer mentions limited resources or fitness trade-offs, but without relating it to reproductive output.

No credit (0 point) if the does not mention limited resources or fitness trade-offs.