Exam IV

Name________________________________________

Total = 100 points

1 (8 points) __________
2 (9 points) __________
3 (8 points) __________
4 (25 points) __________
5 (10 points) __________
6 (10 points) __________
7 (10 points) __________
8 (5 points) __________
9 (15 points) __________

There are 4 pages and 9 questions.

To receive full credit for numerical problems, show your calculations and give the correct units for your answer. Partial credit will be given, so try to provide an answer for all questions.

1. You are studying a gene for carapace (shell) texture in spiny lobsters. Individuals that are homozygous recessive (cc) have a smooth carapace. Individuals that are heterozygous (Cc) or homozygous dominant (CC) have a spiny carapace. The frequency of the spiny allele (C) is 0.6 and the inbreeding coefficient (F) is 0.3.

Calculate the expected genotype frequencies with random mating and with inbreeding. **(15 points)**
2. You are studying the survival of different plant genotypes (AA, Aa, and aa) in a population of wild asters. You plant 50 seeds of each genotype in a field experiment, and then measure the number of adult plants at the end of the season. Here are your results:

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Number of Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>25</td>
</tr>
<tr>
<td>Aa</td>
<td>35</td>
</tr>
<tr>
<td>aa</td>
<td>2</td>
</tr>
</tbody>
</table>

a) Calculate the relative fitness of each genotype. (5 points)

b) The observed frequencies of plants in a natural population of asters are AA = 0.5, Aa = 0.4, and aa = 0.1. Calculate the mean fitness of the population (5 points)

c) Calculate the genotype frequencies after selection and random mating have occurred. (5 points)

d) Explain the changes in allele frequency that have occurred. If this type of selection continues for many generations, what will be the eventual outcome? (5 points)
6. List the assumptions of the Lotka-Volterra predator-prey model (10 points)

7. Species interactions are often considerably more complex than described by our simple mathematical models. What are some of the biological complexities that permit the coexistence of similar species of ant lion larvae in central Oklahoma? (10 points)
8. What determines the period and the amplitude of the cycles in the Lotka-Volterra predation model? (5 points)

9. Define or explain the following terms (3 points each):

   evolution

   natural selection

   $\alpha$ (in the competition model)

   spreading the risk (in a metapopulation)

   rescue effect