Exam II

Name________________________________________

Total = 100 points

1 (25 points) __________
2 (13 points) __________
3 (12 points) __________
4 (10 points) __________
5 (15 points) __________
6 (25 points) __________

There are 4 pages and 6 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. A population of spiders ( predator) and flies (prey) are growing in perfect accordance with the Lotka-Volterra predation equations. For this predator-prey system, you measure the following coefficients:

   \[ r = 1.0 \text{ flies/fly*week} \]
   \[ \alpha = 0.1 \text{ (flies/fly*week) / spider} \]
   \[ d = 0.5 \text{ spiders/spider*week} \]
   \[ \beta = 0.1 \text{ (spiders/spider*week) / fly} \]

   a) How many spiders are needed to maintain the fly population so that \( dV / dt = 0 \)? (8 points)

   b) What is the period of the predator-prey cycle? (8 points)

   c) What determines the amplitude of the predator-prey cycle? (9 points)
2. What is iteroparity? Describe two selective forces that may lead to the evolution of iteroparity. (**13 points**)

3. What is the difference between a “source” and a “sink” population, and why is this distinction important in conservation biology? (**12 points**)

4. Describe one mechanism by which predators and prey can coexist in nature, and describe an example of this mechanism, based on your lecture notes or course readings. (**10 points**)
5. Foraging rodents, such as kangaroo rats may be sensitive to the presence of predatory hawks. In a laboratory experiment, a researcher measures the foraging of kangaroo rats on sesame seeds (low-quality reward) and sunflower seeds (high-quality reward). The experiments are run in the presence and absence of a hawk mannequin. For each experimental treatment, the researcher measures the grams of food consumed per hour. Here are the experimental results:

<table>
<thead>
<tr>
<th></th>
<th>Hawk mannequin absent</th>
<th>Hawk mannequin present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesame seeds</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Sunflower seeds</td>
<td>40</td>
<td>20</td>
</tr>
</tbody>
</table>

a) In the space below, graph these results in terms of foraging reward and predation risk. (10 points)

b) Based on this graph, briefly describe the foraging strategy of the kangaroo rat. (5 points).
6. You are studying competition between red and green Christmas ants. For the red ant, \( K_1 = 100 \) and \( \alpha = 2 \). For the green ant, \( K_2 = 60 \) and \( \beta = 0.5 \). Suppose the initial population sizes are 10 red ants and 10 black ants.

a) Graph the fully-labelled state space and isoclines for each species, and plot the point representing the initial population sizes in the state space. (15 points)

b) Predict the short term dynamics of each population and the final outcome of interspecific competition. (10 points)