Exam II

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 the metapopulation dynamics of frogs in a set of ponds that are connected by immigration and extinction. For each pond, you measure instantaneous birth and death rates for the local population (b and d). Here are what your numbers look like:

Pond	Birth rate	Death rate
A	0.50	0.10
B	0.50	0.30
C	0.50	0.60
D	1.0	1.5
E	0.0020	0.0025
F	0.70	0.71

Which **two** of the ponds would be most important to preserve if you wanted to ensure the long-term persistence of the metapopulation? Why? What sort of metapopulation structure is probably exhibited by this system? **(8 points)**

2. List the assumptions for the basic metapopulation model. **(8 points)**

3. If a simple metapopulation is growing with parameters $p_i = 0.6$ and $p_e = 0.4$, what is the fraction of sites occuped (f) at equilibrium? **(8 points)**

4. You are studying competition between red and black desert scorpions. For the red scorpion, $K_1 = 100$ and $\alpha = 2$. For the black scorpion, $K_2 = 150$ and $\beta = 3$.

   Suppose the initial population sizes are 25 red scorpions and 50 black scorpions. Graph the state space and isoclines for each species and plot these initial population sizes. Predict the short-term dynamics of each population and predict the final outcome of interspecific competition. **(25 points)**

5. In the space below, draw the space state diagram for the Lotka-Volterra predation equations. Be sure to carefully indicate the predator and prey isoclines and to fully label each axis. Draw the trajectory that is traced by the predator and prey populations in this model **(10 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)**:

escape in numbers

neutral equilibrium

α (in the competition model)

spreading the risk (in a metapopulation)

rescue effect