 Biology 217: Ecology Second Exam Spring 2009 *Name:*_____

There should be 10 pages in this exam - take a moment and count them now. Put your name on the first page of the exam, and on each of the pages with written questions.

Please fill in the first character or two of the sections on the front of the Bubble sheet, including Student ID Number, name, and course information (3100-217-001).

The following equations and constants may be helpful:

$\lambda \; N_{t+1} / N_t$

$R_o = \sum l_x m_x$

$N_t = N_o \lambda^t$

$N_t = N_o e^{rt}$

$T = x \, l_x m_x / R_o$

$dN/dt = rN$

$dN/dt = rN(1-N/K)$

$dN_1/dt = r_1N_1(1-N_1/K_1 - a_{12}N_2/K_1)$

$dN_2/dt = r_2N_2(1-N_2/K_2 - a_{21}N_1/K_2)$

$dH/dt = rh-pHP$

$dP/dt = apHP-mP$

$R_p = S\beta L$

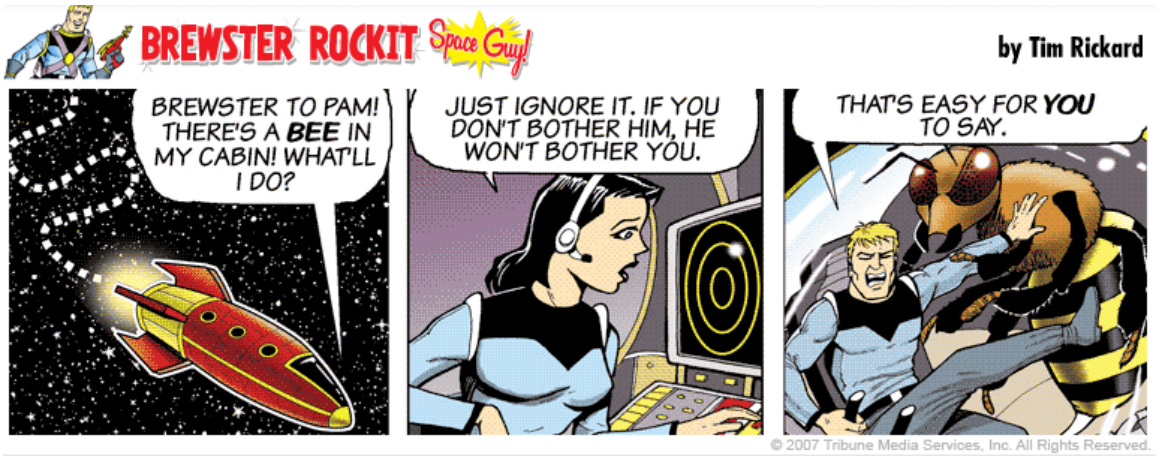
$S_t = 1/\beta L$

$PV = nRT$

$e = 2.72, \; \pi = 3.14159$

$\ln(2) = 0.69, \; \ln(1) = 0$

$E = mc^2$



Multiple choice (19, @ 2 pts each): _____ x 2 = _____/ 38 points

20) Short Answer _____/ 4 points

21) Short Answer _____/ 4 points

22) Short Answer _____/ 4 points

23) Short Answer _____/ 6 points

24) Short Answer: _____/ 8 points

25) Essay (Pre-prepared) _____/ 15 points

_____

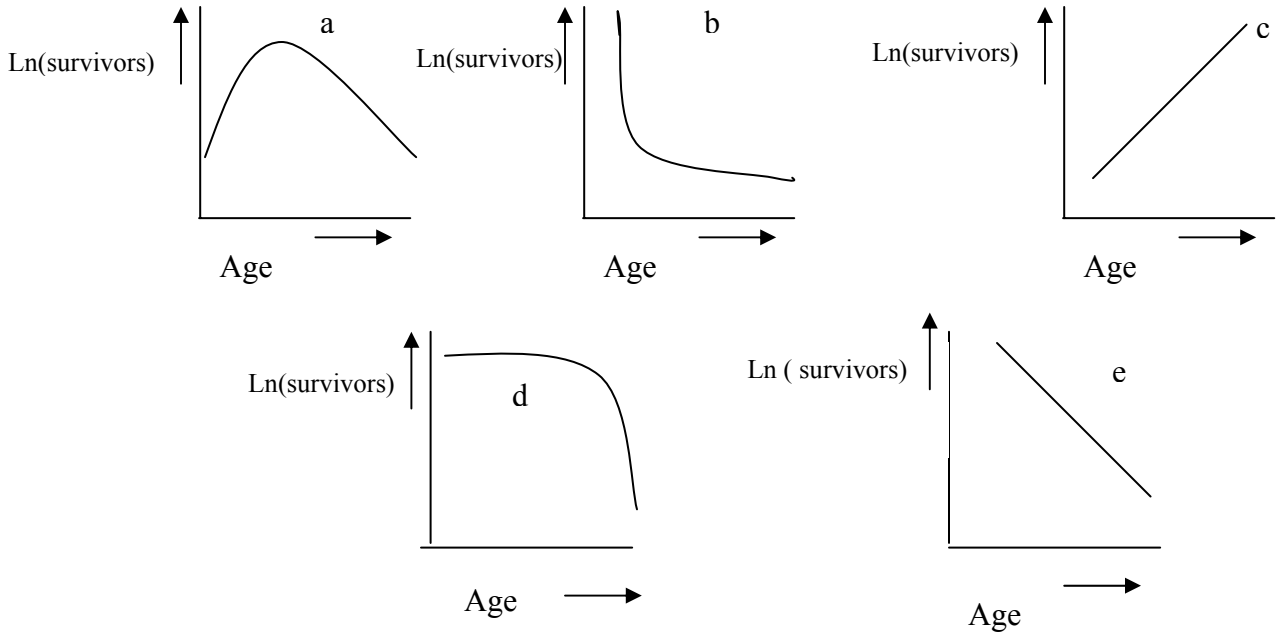
Essay (pre-prepared)

TOTAL: _____**/ 75 points**

You buttered your bread, now lie in it.

Multiple Choice questions: 2 points each. Please put your answers to this section on the Bubble Sheet. Feel free to use the question sheet for scratch work. Each question has only one correct answer. You will not be penalized for guessing on this section. Fill in your Bubble Sheet carefully. Make sure that the number of the question matches the number whose bubble you're filling in!

1) In type III survival, death is strongest in the youngest age classes. Which of these curves best shows a type III survivorship curve?



2) If a population grows in the manner predicted by the exponential growth equation and the population size increased from 10,000 to 20,000 in one year, how long will it take for the population to grow from 20,000 to 40,000?
   a) Insufficient information is provided to make the calculation
   b) 0.5 years
   c) 1 year
   d) 2 years
   e) 4 years

3) Given what you know about exploitative interactions, which of the following best fits the definition of a parasitoid?
   a) A blood-sucking flea that causes little damage other than an annoying rash on the host.
   b) A praying mantis eating its mate
   c) A wasp that lays its eggs inside of a caterpillar, and the resulting wasp larvae then eat the caterpillar from the inside out
   d) A ladybug that eats aphids

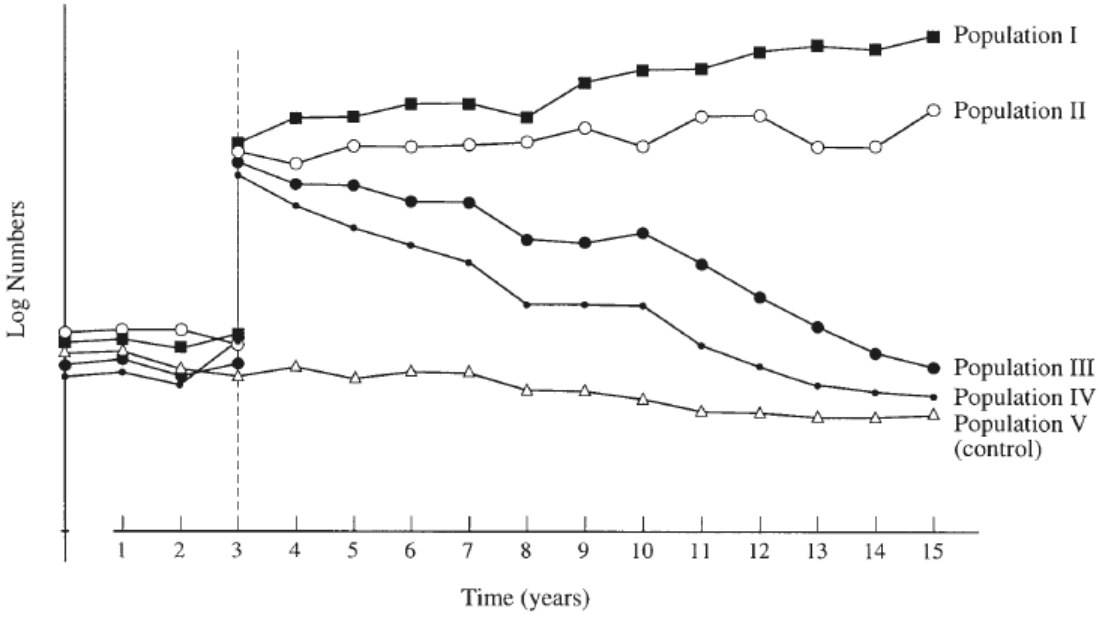
4) In the following equation, what does "K" represent?

$$dN/dt = rN(1-N/K)$$

a) The maximum intrinsic per capita growth rate.
b) The carrying capacity
c) The initial population size
d) The population size giving maximum growth
e) The abundance of predators

5) Which of the following did Robert MacArthur observe and study?
a) Warblers (birds)
b) Salt Marsh grasses (*Spartina* species)
c) Barnacles (*Balanus* and *Chthalamus*)
d) Paramecium *(Paramecium caudate* and *Paramecium aurelia)*
e) African mammals (Zebra, Eland, Wildebeast, Giraffe)

6) Five similar populations of an herbaceous annual plant are monitored for three years. Then an experimenter adds individuals in populations I, II, III, and IV to artificially elevate their abundance. Population V is not manipulated. Subsequent changes in the sizes of all the populations are shown in the graph below.

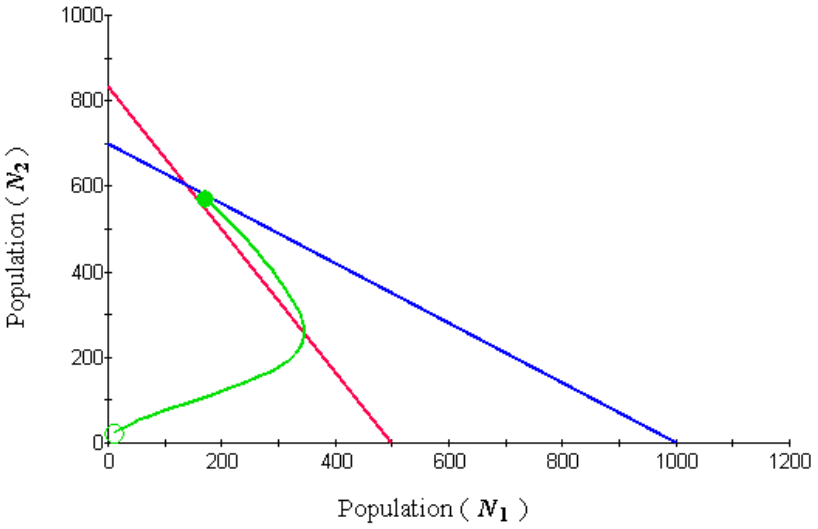


The researcher argues that some populations responded as though there was density dependent population regulation? Which populations show this density dependent response? (assume that the size distributions of all populations are the same)

a) Populations I and II compared with population V
b) Populations I and II compared with populations III and IV
c) Populations III and IV compared with population V
d) Population I compared with population II
e) Population III compared with population IV

7) In class we discussed how a hummingbird may exclude other nectar foraging animals by aggressively defending a territory. This is an example of:
   a) Commensalism
   b) Exploitation competition
   c) Interference competition
   d) Predation
   e) Mutualism

8) This graph was used in our consideration of which of the following interactions?
   a) Competition
   b) Predation
   c) Mutualism
   d) Amensalism
   e) Commensalism



9) Still referring to the same graph as in the previous question, which of the outcomes discussed in class does this graph indicate?
   a) A stable limit cycle
   b) Neutral stability
   c) Stable coexistence of two species
   d) Predators overeating their prey
   e) Overshoot of the carrying capacity

10) Compared to r-selected animals, **K-selected** animals should have:
   a) Lower survivorship
   b) Greater predator satiation
   c) Better competitive ability
   d) A shorter generation time
   e) Faster reproduction

11) How is logistic growth different from exponential growth?
   a) Logistic growth is most applicable to r-selected species, while exponential is not
   b) Logistic growth involves density dependence, while exponential does not
   c) Logistic growth is used primarily to study predator-prey interactions, while exponential is not.
   d) Logistic growth is best evaluated by using a log scale on the vertical axis, while exponential is not
   e) Logistic growth does not involve a carrying capacity, while exponential growth does

12) Your book uses 'masting' by oak trees (*Quercus* sp.) as an example of which of the following?
   a) Competitive exclusion
   b) Character displacement
   c) Predator satiation
   d) Mutualistic release
   e) Resource limitation

13) If you are studying a population of the annual plant *Impatiens capensis* (Jewelweed) in which $\lambda = 1.0$, the population is:
   a) staying the same size
   b) increasing
   c) competing with other species
   d) decreasing
   e) above the carrying capacity

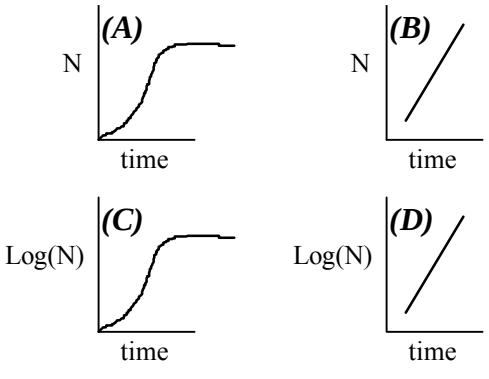
14) Your book describes an interaction between starlings, pill bugs and spiny-headed worms. The text presented evidence that:
   a) The worms cause the starlings to defecate more frequently
   b) The pillbugs are predators of the worms
   c) The pill bugs are parasites of the starlings
   d) The worms alter the behavior of the pill bugs
   e) The starlings are parasites of the worms

15) In wild populations, the most common outcome of interspecific (between-species) competition is:
   a) unimportant -- competition has almost never been confirmed to occur
   b) both species coexist (evenly matched competition)
   c) linked cycles – the two species both oscillate in abundance
   d) one species is excluded (asymmetric competition)
   e) a stable limit cycle

16) When studying studying competition between two species of frogs (*Rana* sp.), you learn that the carrying capacity for *Rana pipiens* is 433, and that for *Rana sylvestris* is 271. According the Lotka-Volterra competition model, which of the species will win?
   a) *Rana pipiens*
   b) *Rana sylvestris*
   c) They will both go extinct
   d) They will coexist
   e) There is not enough information to tell

17) Which of these graphs best demonstrates purely exponential growth?

   (e) None of the above



18) Which of the following equations would be most useful for calculating the net reproductive rate (average number of offspring per female)?
   a) N_{t+1} / N_t
   b) R_0 / T
   c) $\Sigma(x l_x m_x)/R_0$
   d) $\Sigma(l_x m_x)$
   e) SßL

19) Blue Gill (*Lepomis macrochirus)* in Ohio begin reproducing at 1-2 years of age, and produce young once (and perhaps twice) a year during a 4-6 year lifespan. The technical term to describe this life history is:
   a) Semelparous
   b) Age Distribution
   c) Iteroparous
   d) Ruderal
   e) Survivorship

SHORT ANSWER QUESTIONS:

20) (4 points) Suppose you are the only population ecologist in a small nation that has limited space and limited natural and financial resources. The president of the nation comes to you seeking advice about how to slow the growth of his Nation's human population. Based on what we've learned in class, please list **two** measures you would advise, and explain how and why they would be likely to help.

21) 4 points. Sketch a properly labeled Age Pyramid graph for a population undergoing rapid growth. Explain how this graph exemplifies rapid growth.

22) 4 points. African annual killifish live in temporary pools, where their populations survive the dry season as eggs that lie dormant in the mud, developing and hatching only when the pools fill each wet season. In contrast, the guppy, a common aquarium fish, lives in populations consisting of mixed-age classes in which reproduction occurs year-round. Which model of population growth, exponential or geometric, would be most appropriate for each of these fish species? Why?

23) (6 points). Draw a fully labeled graph depicting the abundances of a predator and its prey over time, based on what we covered in class. Explain your graph in a sentence or two.

24) (8 points) An ecologist observed that 6 species of herbivorous leafhopper insects coexist on sycamore (*Platanus occidentalis*) leaves, and concluded that the competitive exclusion principle was false.

a) Explain the competitive exclusion principle in a sentence or two.

b) Give two alternative hypotheses that would fit these facts but still be consistent with the competitive exclusion principle

c) Now briefly describe an experiment or observation that would allow you to test one of these hypotheses

25) 15 **points.** *YOUR REVIEW SHEET HAD 3 QUESTIONS YOU WERE TO PREPARE FOR. OF THOSE, THIS IS THE ONE YOU MUST ANSWER. REMEMBER: your answer should be well reasoned and well written -- outline format is not acceptable (though you may outline the answer for your own benefit on the back of another page).*

Suppose that you are a wildlife biologist with responsibility for managing white-tailed deer in Ohio. Explain why you would be interested in knowing the relative importance of density independent and density dependent factors for these animals. Describe an experiment or observation that might help you determine the extent of density dependence. What sorts of results would support the hypothesis of density dependence? What sorts of results would support the hypothesis of density independence?