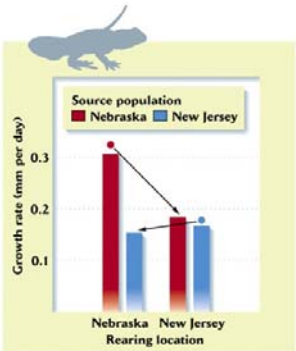
Exam II. Principles of Ecology. October 17, 2007. Name _____

$N_t = N_o\lambda^t$ $N_t = N_o e^{rt}$ $N_{t+1} = N_t + r_o N_t(1-N_t/K)$ $N_t = K/(1 + [(K - N_o)/N_o] * e^{-rt})$

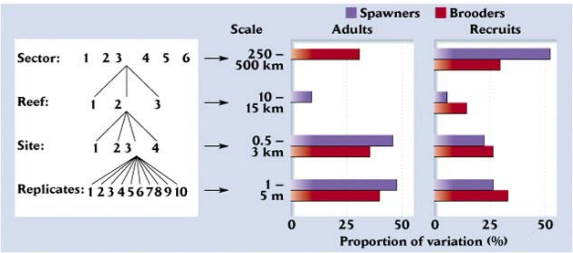
$dN/dt = r_o N(1-N/K)$ $\frac{N_{\text{captured and marked initially}}}{N_{\text{total}}} = \frac{N_{\text{marked at recapture}}}{N_{\text{total recaptured}}}$

Multiple guess. Pick the best answer. [5 points each, 40 pts total]

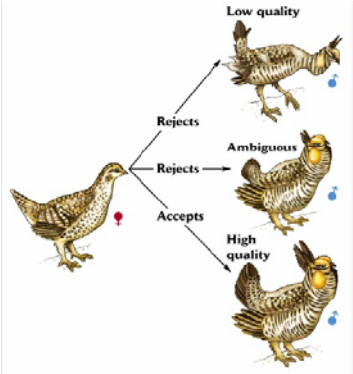
1. If you conducted an experiment on fenced lizards to test reaction norms for individuals from Nebraska (NB) and New Jersey (NJ) your best conclusion, based on the results on the right, would be that growth rates are
   a. mostly environmentally determined for NB lizards and genetically determined for NJ lizards.
   b. mostly genetically determined for both lizards.
   c. mostly genetically determined for NB lizards and environmentally determined for NJ lizards.
   d. mostly environmentally determined for both lizards.
   e. decreasing over time.



2. If a null hypothesis (H_o) is reject then which of the following **must** have had to be true?
   a. $p \leq 0.05$.
   b. $p \leq \alpha$.
   c. $p = 0.05$.
   d. $\alpha \leq p$.
   e. none of the above.
3. We read and discussed a paper by Alison Galvani titled "Epidemiology meets evolutionary ecology." She argued that
   a. virulence is a pathogen trait that does not evolve because vertebrate immune systems largely constrain virulence.
   b. the growth of the human population influences the evolution of pathogen virulence.
   c. virulence of pathogens tends to decline over time due to evolution.
   d. all of the above.
   e. none of the above.
4. The best measure of fitness is
   a. whether an individual survives to reproductive age.
   b. whether individuals are able to reproduce.
   c. the absolute number of offspring produced by individuals.
   d. the relative number of offspring produced by individuals.
   e. nothing, since "survival of fittest" is no longer a credited measure of evolution.
5. The figure on the right from lecture and your book represents how scale can influence our understanding of ecological systems. Which of the following best describes the data presented in the graph?
   a. There are large differences in coral abundances at small and large scales.
   b. There are small differences in coral abundances at small and large scales.
   c. The abundance of corals is independent of scale.
   d. Ecological systems are so complex that we really can't understand anything (the variance should be near zero for us to really understand these patterns).
   e. The population of corals is declining.



6. Imagine you are estimating a population of cats in a city and use the mark-recapture technique. On the first capture you catch and mark 100 cats. On the second capture you get 90 cats and 30 are marked. You then discover that cats like being trapped because the traps are baited with live mice. What is your estimate of the population and what do you think of your estimate given your recent discovery?
   a. 300, but it's an overestimate of the population (there are really fewer cats in the population).
   b. 300, but it's an underestimate of the population (there are really more cats in the population).
   c. 220, but it's an overestimate of the population (there are really fewer cats in the population).
   d. 160, but it's an underestimate of the population (there are really more cats in the population).
   e. Your answer: _____.
7. An endangered population goes from 950 to 388 over the period of one year. What's "r" during this period?
   a. -0.9
   b. -0.75
   c. -0.6
   d. 0.41
   e. other: _____
8. The image to the right is based on Bill Hamilton's and Marlene Zuk's paper. Which of the below best represents their main point?
   a. Jungle fowl discriminate between males based on posture.
   b. Jungle fowl males of very low quality still gain access to females, even if females reject them.
   c. Jungle fowl females favor males that appear to be able to fly despite being flightless themselves.
   d. females assess males based parasite loads.
   e. sexual dimorphisms arise due to different gender function.



Answer two of three short answers questions (10 pts; 5 pts ea. -2 pts for the first missed one, -1 thereafter)

1. What are the four easily observed characteristics of natural selection?
   a. _____
   b. _____
   c. _____
   d. _____

2. Describe four mechanisms we discussed by which the frequency of genes can change in a population.

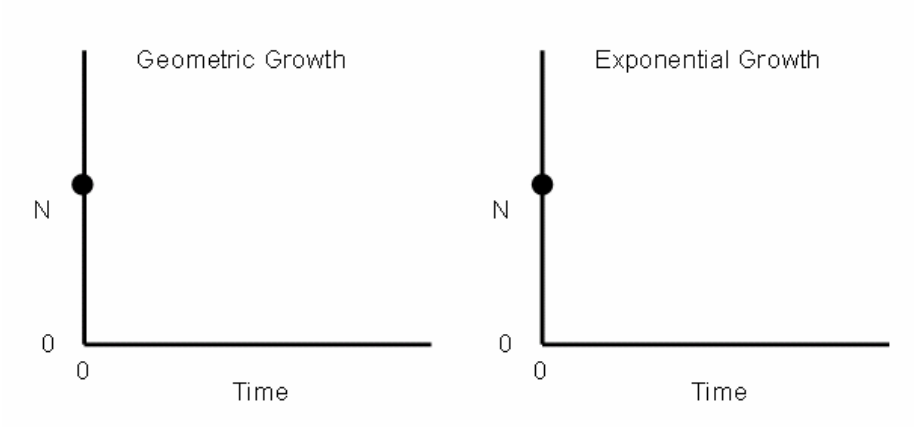
   1.

   2.

   3.

   4.

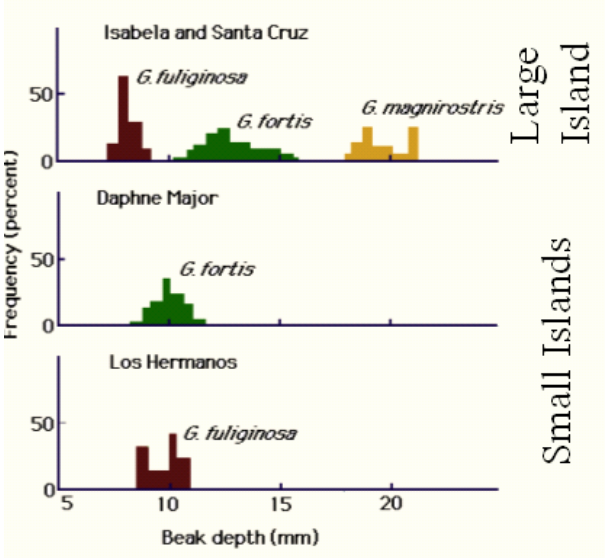
3. Below graph N vs. time for geometric and exponential growth. Show three scenarios for each.



Long, tedious answers. Answer **FOUR** of **FIVE**. [10 pts each, 40 pts total]

1. Quantitatively explain Cole's Paradox.

2. The graph on the right shows histograms of the frequency of beak depths by three species of the Galapagos finches on three different islands. Explain why these data do or do not provide evidence for evolution.



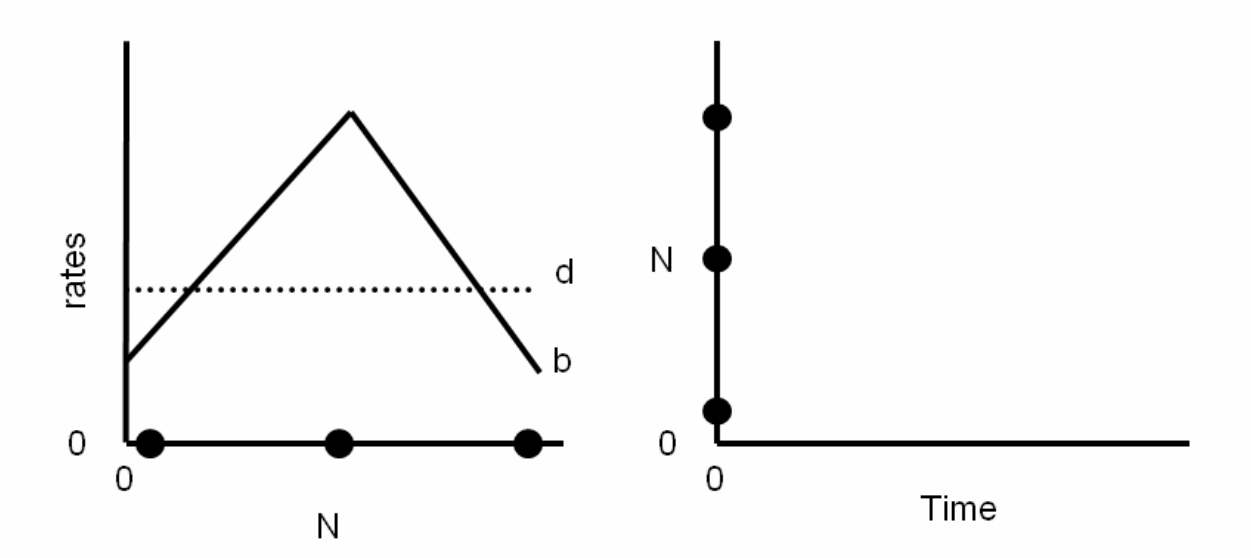
3. In the square to the right please draw a population that at the largest scale is randomly dispersed and uniformly dispersed at the smallest scale. Note that I am not asking for three different maps showing three different patterns. This is a single map.

4. Draw the relationship between instantaneous rate of increase of organisms (r) against the body mass for all organisms on Earth.

5. Based on the work by Hartvigsen et al. explain how to achieve global cooperation where individuals are represented simply as probabilities of cooperating and reside on a chessboard-like universe.

Mandatory Question. 10 points.

1. "Analyze the graph" on the left and complete the graph of N versus time on the right (5 pts each). Use each dot as a starting place for a population. Note that d and b represent birth and death rates, respectively.



Extra Credit

1. Several years ago Joel Berger tested the effect of wolf feces on moose behavior. What did he find? (2 pts)

2. His most recent discovery was what? (2 pts)

3. Al Gore recently won the Nobel Peace Prize for his efforts to increase awareness of the problem of global warming. Why is this worthy of a ***peace*** prize and isn't just a political stunt? (2 pts)

4. Who also won the Nobel Peace Prize with Gore (1 pt) and for what (1 pt)?