

The exam is worth 100 points with five extra credit points possible.

Multiple guess. Circle the letter of the best answer. [3 points each, 60 pts total]

- The graph to the right depicts the variability in four traits from fruit flies and mice. Which of the following best explains why this variability is maintained in such populations? **TOSSED OUT**

 - cross-reactivity in trait space.
 - traits are coded for by genes.
 - genetic recombination.
 - natural selection operates on trait distributions.
 - all of the above.
- Which of the following is an example of stabilizing selection discussed in the Arboretum?

 - bees pollinating bigger flowers.
 - the relative growth rates of trees.
 - the amount of pollen produced by asters.
 - the height to which grass grows.
 - the flowering times of goldenrods.**
- Which of the following did Darwin suggest would threaten, or invalidate, his theory of evolution by means of natural selection?

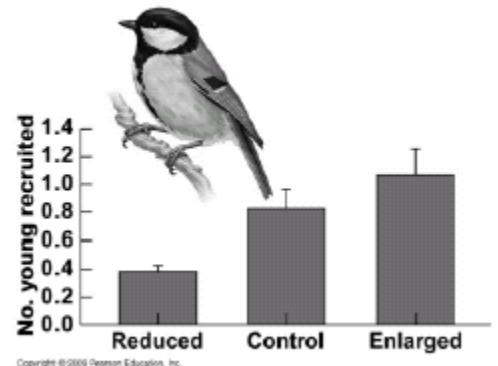
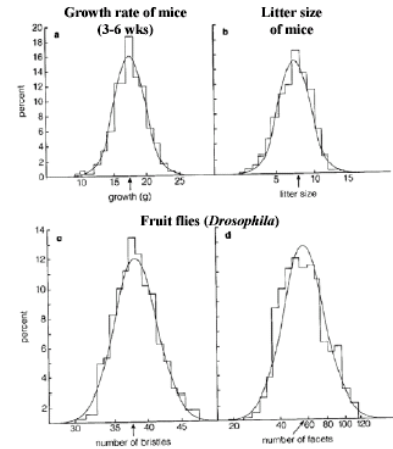
 - If his theory of blending inheritance was correct.**
 - If the Galapagos finches were really separate species.
 - If people were shown to be descended from monkeys.
 - If his theory of inheritance of acquired characteristics was shown to be wrong.
 - If traits were really genetically based then natural selection could not operate.
- Convection rolls are responsible for which of the following?

 - Plate tectonics.
 - Heavy rains at low latitudes.
 - Polygons forming in oil heated in a skillet.
 - All of the above.**
 - None of the above.
- Which of the following is the best definition of “fitness”?

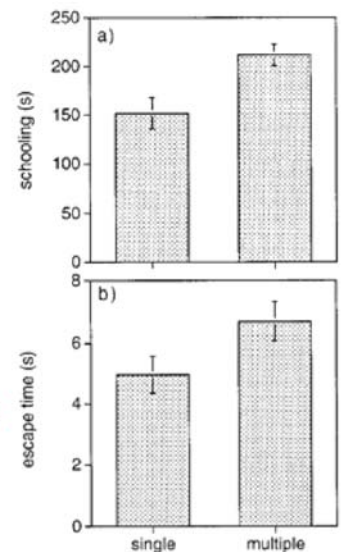
 - The health of offspring produced by parents relative to the health of those in the population.
 - The slope of the relationship between mean phenotype of the parent and the offspring’s phenotype.
 - The number of offspring produced by an individual relative to the average number produced by members of the population.**
 - All of the above.
 - None of the above.
- Which of the following best identifies Lack’s hypothesis about the number of offspring produced by organisms?

 - Birds should produce the number of offspring produced by their parents, thus ensuring the continuation of the species.
 - Birds should maximize the number of offspring produced.
 - Birds should produce the average number of offspring produced by a population.
 - Birds should minimize the number of offspring produced but rear those successfully.
 - Birds should lay the number of eggs that will lead to the highest number of chicks fledged.**
- The data in the figure (from your text and lecture)

 - support Lack’s hypothesis.
 - contradict Lack’s hypothesis.**
 - support the theory of acquired characteristics.
 - support the theory of island biogeography.
 - have nothing to do with answers a-d.



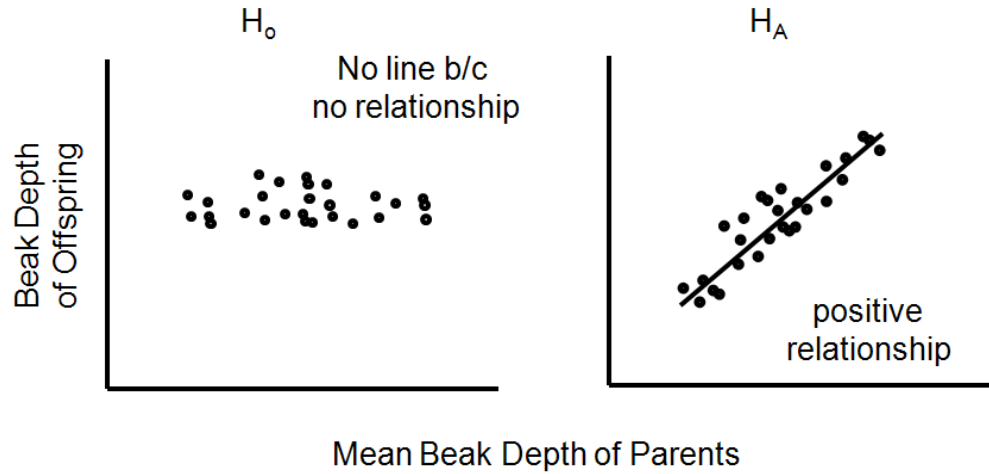
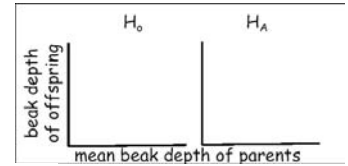
8. What's "p" given the following frequencies of genotypes?
 $A_1A_1 = 20$, $A_1A_2 = 50$, $A_2A_2 = 80$.
- 0.133
 - 0.233
 - 0.300**
 - 0.700
 - 0.950
9. Based on the data above and our knowledge of the Hardy-Weinberg Law we calculate the expected number of individuals of each genotype. We then calculate a chi-square value and get $X^2 = 6.39$ and $p = 0.041$. Given this we should conclude
- the population is in Hardy-Weinberg equilibrium.
 - the population is not in Hardy-Weinberg equilibrium.**
 - the population is moving toward Hardy-Weinberg equilibrium.
 - the population is moving away from Hardy-Weinberg equilibrium.
 - nothing since we do not yet have enough information.
10. In the paper "Multiple benefits of multiple mating in guppies" the authors found which of the following to **not** be a benefit (graph from lecture; info from your book):
- larger broods.
 - offspring have better developed schooling abilities.
 - offspring are better at escaping predators.
 - all of the above.
 - none of the above**
11. Which of the following is **not** a reason that small forest birds such as warblers migrate between breeding areas at high latitudes and south in the winter?
- Escape from egg predators such as snakes.
 - Escape from the cold.
 - They seek areas with high resource abundance.
 - All of the above explain this migration.**
 - None of the above is a reason for these birds to migrate.
12. Rapoport's rule is best described by which of the following?
- Population sizes and ranges tend to increase together.
 - Higher latitude species tend to have larger range sizes.**
 - Range sizes tend to decrease with increasing latitude.
 - All of the above are consistent with Rapoport's Rule.
 - None of the above.
13. We discussed, as did your book at length, the relationship between population density and body weight for many different species. Thinking about this relationship (making the graph helps!) which of the following is most common?
- positive slope, positive intercept.
 - negative slope, positive intercept.**
 - positive slope, negative intercept.
 - negative slope, negative intercept.
 - all of the above.
14. We capture and mark 73 mice in the Roemer Arboretum. We release them and one week later capture 100 mice, of which 23 are marked. Assuming no violations of the Lincoln-Peterson technique occur what is our estimate of the population (note these values may be rounded down)?
- 31.
 - 103.
 - 196.
 - 317.**
 - 996.



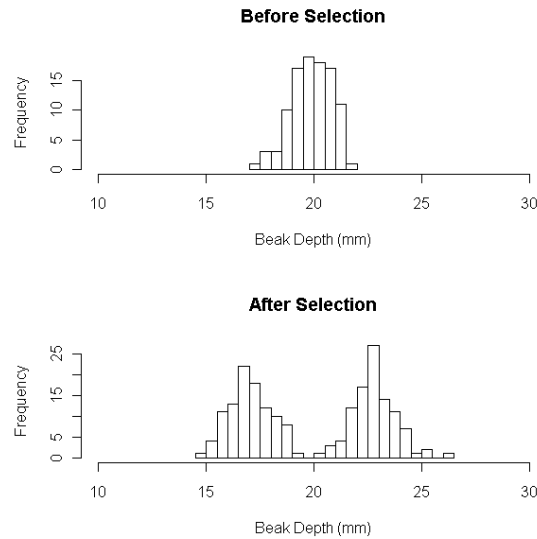
15. You were asked to view a PBS movie “Crash: a tale of two species.” Which of the following best describes the main story line?
- How bighorn sheep use their big horns to bring down predators when threatening their young.
 - How humans are affecting fish species.
 - How cell phone towers and windmills are disrupting migratory birds.
 - The effect of humans running over critters with their vehicles.
 - How humans are negatively affecting the relationship between red knots and horseshoe crabs.**
16. “The Flying Spaghetti Monster created the Universe.” Which of the below best describes this hypothesis and how we would deal with it in science.
- It’s a good, testable scientific hypothesis.
 - It’s a poor hypothesis because it can’t be tested.**
 - It’s a good hypothesis because it can be proved wrong.
 - It’s a poor hypothesis because it is wrong.
 - It has already been proved wrong.
17. Reid’s paradox is
- the idea that ranges of species increase with increasing latitude.
 - the idea that the ranges of tree species increased more quickly than possible given average seed dispersal distances.**
 - the idea that range expansions appear to occur more slowly than seed dispersal data suggest.
 - the finding that population densities are inversely related to reproductive rates.
 - All of the above were paradoxes to Reid.
18. A theory is a “comprehensive explanation of natural phenomena supported by extensive evidence gathered through observations and/or experiments.” Below are paired examples of theories. Which one is theory supported by data and is followed by a theory defeated by data?
- | Current Theory Supported by Data | Theory Defeated by Data |
|--|--|
| a. Earth-centered Solar System | Heliocentric Solar System |
| b. Humans and dinosaurs lived together | Theory of evolution by means of natural selection |
| c. Spontaneous generation | Cell theory |
| d. Cell theory | Heliocentric theory |
| e. Evolution occurs by mutation | Theory of evolution by acquired characteristics |
19. If a planet has a molten core, an atmosphere, sustains life, and revolves around a star, what two of the below are required for there to be seasons?
- Tilted axis and an atmosphere.
 - Tilted axis and a rotation not equal to one prograde rotation per revolution.**
 - Tilted axis and a rotation equal to one prograde rotation per revolution.
 - It must rotate and have an elliptical orbit.
 - It must revolve and have an elliptical orbit.
20. Your book suggested that you could just look at Table 1.1 in the text and see the relationship between total fertility rate and gross national income per person. I didn’t buy this and neither did you! When you graphed these data you discovered (choose the best answer, recalling our final assessment of R Module #1):
- a positive correlation on a log scale.
 - a positive correlation on a linear scale (no log transformation).
 - a positive dependency of income against fertility rates.
 - a positive dependency of fertility rates on income.
 - a negative relationship between these variables.**

Short answers. Please constrain the length of your answer to the space provided (10 pts ea., 30 pts total)

1. Provide the null and the expected (H_A) relationships for heritability of beak depth (discussed in class).



2. Provide two **histograms** that show a population before and after disruptive selection. Be sure to label your axes and clearly identify what trait is affected.



3. Provide a graph of the expected relation of geographic range size as a function of population abundance, as discussed in lecture and your text (figure 7-12, pg 107). State the main result and provide an example from lecture or the text. **See figure in text.**

10 point question

1. Describe the four easily observed characteristics of natural selection? (2.5 pts each)
 - a. See syllabus
 - b.
 - c.
 - d.

Extra Credit (5 pts possible)

1. What does the darker stuff in the image to the right show (spelling counts)? (1 pt)



2. What news was associated with the person shown? (1 pt)



3. Fill in the blanks based on what was in the news (1 pt each): If the _____ is planted with trees then the planet might be expected to cool by _____ degrees (nums and units needed).
4. What Californian organism/species was nearly extinct but, after protection, its population grew and spread in a way that was consistent with diffusion? (1 pt)

Points = _____