

READ THESE INSTRUCTIONS: there are three sections to the test. You must answer **both questions in Section I**. Choose ONE to answer in Section II. Choose **TWO to answer in Section III**. The answer length limit for each section of each question is given with the question. Do not exceed that limit.

**Section I (You must answer BOTH questions)**

**A. (25 points) Optimality Theory**

- a. (no more three sentences) What does it mean for an animal to behave optimally?
- b. (no more than three sentences) What is an optimality model?
- c. (no more than a paragraph) What are the steps involved in constructing a model of optimal behavior?
- d. (no more half a page) Using an optimality model, explain which of the following strategies (A or B) is the optimal behavior for a chickadee :
  - A. forage for nuts that contain 25 calories each but require 2 minutes to open
  - B. forage for nuts that contain 15 calories each but require 1 minute to open

**B. (25 points) You observe two avian species. In one species (Prairie Grouse), the males provide only sperm to reproduction. In the other species (Leach's storm-petrels), males and females cooperate to provide parental care.**

Answer the following:

- a. (no more three sentences) Explain the trade-off between parental effort and mating effort in terms of fitness.
- b. (no more two sentences) Why is there often a difference in the sexes with regard to that trade-off, particularly in mammals?
- c. (one word) In which of these species is there more likely to be one sex with higher variation in reproductive success (i.e., some individuals of that sex with many offspring, some with very few offspring)?
- d. In one of these species there is more likely to be one sex with extravagant traits?
  - i. (one word) Which species?
  - ii. (one word) Which sex?
  - iii. (one paragraph) Why?

**Section II (Answer ONLY ONE of these) – 30 Points**

B. These are Figures 2 and 3a from Cratsley and Lewis (2003). Use these figures to explain the following with regard to that paper:

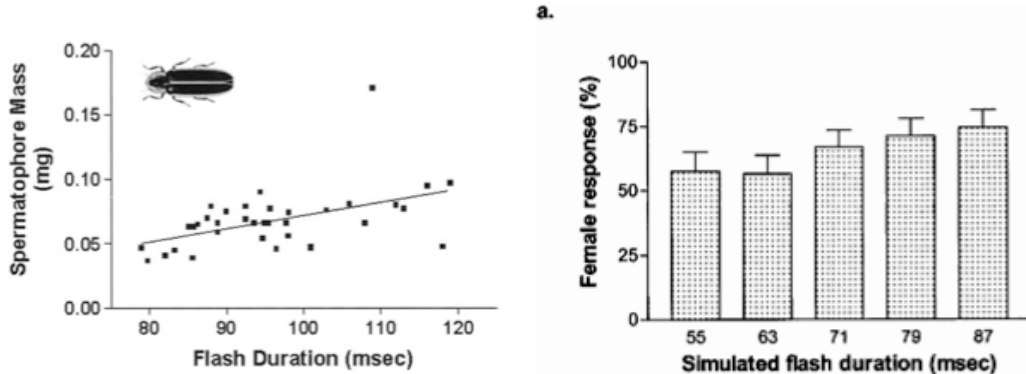


Figure 2

- (no more than one paragraph) What does the figure on the left have to do with honest signaling?
- (no more than one paragraph) What does the figure on the right have to do with to the concept of female choice.
- (no more than half a page) Explain how to view these figures in light of sexual selection and Zahavi's Handicap Principle.

C. Does Figure 2 from Bates and Chappell (2002) show that cultural transmission can be maladaptive?

- (no more two sentences) What is cultural transmission?
- (no more than one sentence) What does it mean for a behavior to be adaptive?
- (no more than one sentence) What does it mean for a behavior to be maladaptive?
- (no more one sentence) What hypothesis was being tested with this figure?

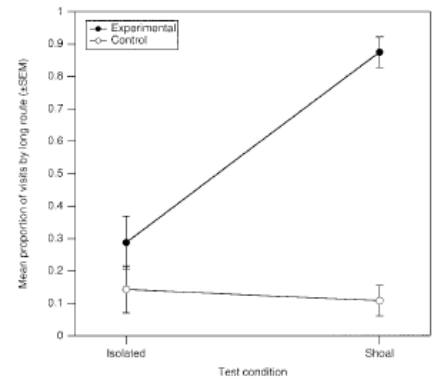


Figure 2  
Mean proportion ( $\pm$ SEM) of trials in which the long route to the feeder was taken by experimental and control fish in each condition.

- (no more than half a page) What conclusions can you draw from this figure with regard to the hypothesis that was being tested and why?

**Section III** (Answer **TWO** of these questions – **10 points each** question)

D. Types of Learning: Classical vs. Operant Conditioning

- a. (no more four sentences) What is Classical Conditioning?
- b. (no more four sentences) What is Operant Conditioning?
- c. (no more one sentence) What is the main difference between these two types of learning?
- d. (one word) Which of these types of learning are more likely to occur in nature?
- e. (no more than a paragraph) Why?

E. Sexual Selection and Natural Selection

- a. (no more four sentences) Explain what conditions are necessary for natural selection to occur.
- b. (no more four sentences) Explain how sexual selection is similar to natural selection.
- c. (no more four sentences) Explain how sexual selection is different from natural selection.

F. In the redback spider, the male inserts its copulatory organs, then does a back flip that places its body next to the female's mouthparts such that the female is able to consume the male during copulation.

- a. (no more four sentences) What could you measure that would support the hypothesis that this behavior is adaptive for these male spiders?
- b. (no more four sentences) What could you measure that would support the hypothesis that this male behavior is maladaptive?

G. (no more than a paragraph) Testosterone has been shown to reduce average male lifespan in some mammal species. Why hasn't natural selection led to the elimination of testosterone or the modification of its survival-threatening effects in mammals?