

Please put your name and ID# on every page of the exam in the space indicated. Please do not exceed the space allowed for short-answer questions (think BEFORE you write). All questions are worth 5 points unless specifically noted otherwise. Multiple-choice questions may have more than one correct answer (although NONE will have all 5 choices correct). To receive full credit for such questions you must mark ALL the correct answers and NONE of the incorrect answers. You will be marked off for each incorrect answer so that completely random guesses will result in a grade of 0. To mark an answer in a multiple-choice question, circle the initial letter before the answer (that is: a), b), c)....).

1. Which of the following are correct statements concerning Mullerian mimics.
 - a) Mullerian mimics often exhibit aposematic coloration.
 - b) Mullerian mimics are always lethal to predators that consume them.
 - c) Mullerian mimics receive the benefits of reduced predation risk without paying the cost of producing poisons.
 - d) Mullerian mimics are not influenced by the mechanism of natural selection.
 - e) Mullerian mimics often exhibit convergence in color and morphology with other Mullerian mimics.

2. Entrainment of the circadian rhythm in mammals:
 - a) Involves activation of the tau gene in the hypothalamus.
 - b) Involves the re-setting of the circadian clock to reflect environmental stimuli perceived by the organism.
 - c) Is caused by production of melatonin in the pineal gland.
 - d) Is mediated by the pacemaker cells in the SCN of the hypothalamus.
 - e) Involves activation of the CREM gene in the pineal gland according to the mammal's recent experiences of light-dark cycles.

3. Which of the following are true statements concerning circannual rhythms.
 - a) Circannual rhythms are often related to and dependent on shifts in an organism's circadian rhythm.
 - b) Circannual rhythms are only driven by seasonal changes in light-dark cycles.
 - c) Circannual rhythms are not influenced by seasonal variation in food resources or temperature.
 - d) Infanticidal behavior in mice is determined by circannual rhythms.
 - e) Circannual rhythms are probably more important for seasonally breeding organisms than organisms that breed continuously throughout the year.

4. List at least three ways in which a prey individual can reduce the chance that it will be captured and killed GIVEN that a predator has detected it. List a cost to the prey's fitness for each avoidance mechanism.
 - a) run away: cost in energy and time spent doing other activities that enhance fitness
 - b) startle predator: cost of building 'startle' form (eg. Eyespots). Need to stay still
 - c) be distasteful: cost of producing defenses. OTHER CHOICES: advertise unprofitability, confuse predator by bunching together, attack back, redirect attack to wrong end of body)

5. Now extinct, Passenger Pigeons were at one time perhaps the most abundant bird species in North America. Naturalists in 1871 noted that there were 136 million Passenger Pigeons breeding in an area of only 850 square miles in Wisconsin. Hunting pressure in the early 1900s reduced the numbers of pigeons significantly but alone cannot explain their extinction. The real reason for the extinction of the Passenger Pigeons requires knowledge about their breeding behavior. What really caused the extinction of Passenger Pigeons and what role did hunting play in that extinction?

Passenger pigeons required large colonies to be stimulated to breed at all. When hunting reduced their populations to low densities, colonies became too small, birds did not reproduce, and thus went extinct.

6. Which of the following would you expect to be true of social groups?
- a) The size of the group would increase with increasing predation pressure
 - b) The size of the group would increase with decreasing predation pressure
 - c) The size of the group would decrease when food occurs in bigger patches
 - d) The size of the group would decrease when food occurs in smaller patches
 - e) Highest ranking animals would be prefer to be located on the edges of a group
7. Given a choice between two behaviors, by what criterion should an organism choose one behavior over another? What role might command centers in the brain play in such a decision?

It should always choose the behavior that provides the best fitness return, compared to available alternatives (the marginal-value principle). Command centers in the brain receive neuronal input from many sensory systems related to stimuli that affect fitness (predators, food,...) and 'decide' among them based on the strength of the inputs and their fitness 'value' relative to other stimuli

8. You are asked to critique a scientist's research plan, but first you make sense of the hypothesis. *The hypothesis is that Brown Capuchin Monkeys give food calls to increase group size and reduce predation risk because of the dilution effect.* You find the following statements in the research plan, but are not sure if they represent assumptions or predictions of the hypothesis. Label each statement to be a Prediction (P) or and Assumption (A) of the preceding hypothesis.

- _P_ Capuchins foraging in areas without predators do not give food calls.
A Capuchins in larger group sizes have lower predation risk. The dilution effect holds true for Capuchin monkeys.
A The benefits of reduced predation risk exceed the costs of sharing food in Capuchin monkeys.
P Capuchins give food calls more frequently as predation risk increases.
A Capuchins have predators.

9. Which of the following are true statements about territorial animals.
- a) Territorial animals generally have smaller home range sizes than non-territorial animals of the same species.
 - b) Territory owners do not need to defend their area aggressively
 - c) Territorial animals usually experience higher reproductive success than non-territorial animals of the same species.
 - d) A territorial animal is the only inhabitant and user of its territory.
 - e) Territorial animals must feed or rest more than non-territorial animals to compensate for the costs of defense.

10. In many social organisms, observed group sizes are LARGER than predicted by optimal foraging theory. Thus, if these animals lived in smaller groups, they would have higher individual feeding rates. Offer one adaptive hypothesis to explain this observation.

Individuals may wish to hunt in larger groups than optimal for food intake because of other selective pressures: predation (if the animals have predators), teaching skills to offspring or relatives, infanticide. Also, solitary individuals may join groups of optimal size even at a cost to those in the group, if the benefit to the solitary animal is large.

11. In which of the following scenarios would you confidently predict that an animal would LEAVE its natal range and establish a NEW range.
- a) The species is incapable of raising its young without the assistance of family members.
 - b) Parental defense of the natal territory prevents any non-kin from entering and limits the pool of potential mates.
 - c) Finding a new range requires considerable search time and effort
 - d) A predator establishes a nest or den near the parent's territory
 - e) Parasites are not generally a problem for this species

12. (10 points) In general, male mammals disperse from their natal range more frequently than do female mammals. On the contrary, female birds leave their natal range more often than do male birds. Why does one sex always disperse further from 'home'? What accounts for the different dispersal patterns between mammals and birds?

One sex always has to move away from home because otherwise individuals would breed with close relatives, and close inbreeding carries severe fitness costs. In mammals, males typically do not defend territories, and females have to raise offspring alone, so that the importance of knowing where resources are makes it advantageous for females to stay near where they were born. In birds, in which both male and female help raise the offspring in most species, and in which males defend territories, it is more advantageous for males to stay close to home and familiar neighbors (even though these are competitors also).

13. What are two benefits of social foraging? What are two costs?

Benefits(2)___1) more eyes to find food patches with; 2) individuals are safer from predator attack; 3) can capture larger prey; 4) share information about food patches_____

Costs(2)___1) more mouths to feed/share the food that is detected; 2) larger group may be more conspicuous to predators_____

14. Which of the following statements concerning migration are true?

- a) The only cost that migrants pay is loss of energy in the migration process.
- b) Migration by birds to and from the New World tropics probably started because insect-eating species could not survive during the harsh temperate-zone winter.
- c) The route by which a migrant moves may vary according to its energy reserves.
- d) Organisms migrating in groups face lower predation risk on average than individuals migrating alone.
- e) Monarch butterfly migration is driven by the need for available breeding sites.

15. Game theory is a branch of behavioral ecology that:

- a) Ignores the costs of animal interactions and only focuses on the benefits.
- b) Predicts the fitness of an animal using a particular behavior based on what other individuals in the population are doing.
- c) Incorporates the randomness of games as an element of animal decision-making
- d) Helps explain why territory owners often win contests without injuring the intruders.
- e) Predicts the stable presence of behavioral types in a population with different average fitness values.

16. Based on the following payoff matrix, which strategy is the ESS? B Would the answer change if all the payoffs in the first column were multiplied by 2000? No

Payoff to:	Against type A	Against type B
Type A	1	1000
Type B	6	1005

17. Provide three distinct explanations for the common observation that owners of resources typically win aggressive interactions with intruders.

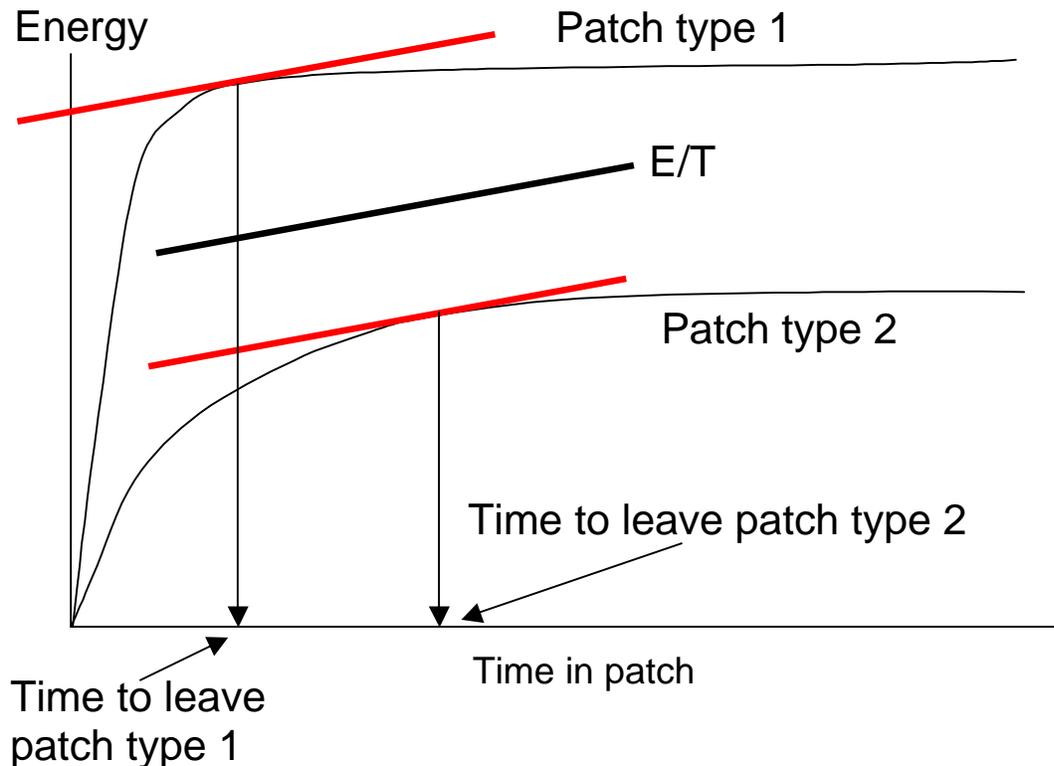
- a) The owners might be stronger, as would be expected if they themselves had to win the resource by defeating previous owners_____
- b) The animals might use an arbitrary cue or asymmetry to decide the outcome, thus saving the time and energy cost of fighting over resources that are not very valuable._____
- c) The value of the resource is greater for the owner because of its knowledge about the resource, and thus it is more willing to fight to retain it than the intruder is to win it.

18. List three (out of at least 6) assumptions made in the simplest diet-choice model.

- a) all items of a given food type are the same in terms of energy (e) and handling time (h)
- b) the forager knows the values of e and h for every food type
- c) the forager can calculate and remember its long-term E/T

(Also: items encountered sequentially one at a time, forager does nothing but forage, no time is spent in recognizing prey or deciding to pursue, digestion occurs at the same time as search and handling, handling time is not available for search)

19. (10 points) The following diagram represents information for a foraging animal using TWO distinct types of patches, with the energy gain curves shown. Also shown, as a slope, is the overall E/T for the animal in this situation. Using this information, show how long the animal should spend in EACH of the two patch types. (hint: do NOT try to extend the line to the left of the y-axis; use the marginal-value principle).



20. How should the diet of an optimal forager change, according the simple diet choice model, if the food types that are NOT part of the optimal diet become much more common than before, leaving their profitabilities the same? (hint: use the marginal-value principle).

The diet should not change at all. If an item is not worth accepting when it is rare, it is not worth accepting when it is common AS LONG AS THE REST OF THE DIET (including the food types already in the optimal diet) REMAIN THE SAME

21. Examples of negative feedback include:

- a) the 'central inhibitor' in the preying mantis 'brain' (head ganglion)
- b) turning off of CREM gene by ICER
- c) breakdown of PER by melatonin
- d) turning off of PER gene by PER product
- e) stretch receptors in the fly foregut reducing appetite

22. Castration of an adult male mammal is likely to reduce which of the following:

- a) motivation to mate
- b) song learning
- c) intelligence
- d) aggressiveness
- e) navigational ability

23. What characteristics of the environment and prey should favor the use of touch as the major sensory mode for prey detection? (hint: think of the alternative modes as well).

Touch is very short-range, so should NOT be favored if longer-range cues are feasible – so environment should not have much (or any) light, and should not transmit sound or smell well. An example would be underground foragers like moles and nocturnal foragers that cannot locate their prey by sound or smell (leaf-eaters). The prey should be common because detection range is short and otherwise the forager is likely to starve.

24. One of the hypotheses about the adaptive value of alarm calls is that they advertise the caller's unprofitability to the predator. If correct:

- a) Predators will be less likely to attack after an animal alarm calls than if it does not
- b) Only animals in groups should give alarm calls
- c) The calling individual should look away from the predator toward other group members
- d) Alarm calls should be given only after an attack has begun
- e) Alarm calls should be easy for the predator to detect and locate

25. The diagram below is consistent with which of the following hypotheses about the advantages of grouping:

- a) selfish herd
- b) confusion effect
- c) cooperative capture
- d) dilution
- e) enhanced vigilance

(if you felt that the separate lines for interior and peripheral animals was not consistent with b,d,or e, and DELIBERATELY left them blank, we will give you full credit)

