1. Define/describe any ten of the following (2 more for extra credit). (2 pts. a piece; 20 pts.).

phenotypic plasticity

parthenogenesis

preadaptation

introsexual selection

inclusive fitness

eusociality

nepotism

senescence

parasitoid

siblicide

monoeocious

haplodiploidy

telomerase

evolutionary constraint

semelparous

viability
2. Suppose there was a bird that could help a sister raise offspring, and that the sister’s fitness would be increased by .47 offspring if helped. Also suppose that the cost (in lifetime fitness) to the helper for helping once would be .21 offspring.

a. Calculate the indirect fitness for this situation for the helper. (2 pts.)

b. Should the helper be willing to help under these circumstances? Why? (2 pts.)

c. Suppose the helper was capable of building its own nest and laying eggs, instead of helping. What other bits of information would you need to know before you could say that the helper should build its own nest instead of helping? There are potentially several other factors that come into play here; please list at least three different things that would influence the helper’s decision. (3 pts.)

d. Suppose in a good year, the “helpers” average fitness (for all potential helping birds) would be .32 offspring if they built their own nests. If the fitness of the sister if helped is as above (.47 offspring), should the helper help, or build their own nest? Why or why not? (2 pts.)

3. In honeybees, indicate, and EXPLAIN, the coefficient of relatedness for a worker to that worker’s: (12 pts.)

a. Sister

b. Brother

c. Daughter

d. Father

e. From the above, which of the above relatives should workers choose to defend most?

f. Can workers within the same hive be related to each other by less than ½? If so, how does this occur?
**TRUE-FALSE (2 pts. a piece):**

___ 4. In most mating systems, access to females tends to be limiting for males, but access to males is not typically limiting for females.

___ 5. Naked mole rats appear to be able to withstand significant inbreeding.

___ 6. Queens in all eusocial insects determine sex ratios of reproductive offspring.

___ 7. For two species that are similar in size, one species can have both a slower metabolism and die younger from aging than the other species.

___ 8. Spite is a common type of behavior in many species of animals.

___ 9. Sexual reproduction can maintain a particularly well adapted genome from generation to generation in a (semi-)stable environment.

**Fill-in-the-Blank (2 pts. a piece):**

10. Asexual reproduction produces __________________________, genetically (virtually) identical individuals.

11. When males and females of the same species are different in appearance, they are said to exhibit sexual __________________________.

12. The most likely type of mate attraction cue to be used by FEMALES is _________________.
   (hint – I’ll give you some choices: bright color, visual display, pheromones, calling, enlarged body parts, etc.)

13. For question 12, WHY are females most likely to use the particular cue you selected? (2 pts.)

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(14 – 15) For each of the following pairs of statements, circle the item that is greater. If the two items are equal then circle the “—” between the two items: (2 pts. a piece)

14. Potential deleterious mutations in the genome of bacterial endosymbionts — Potential deleterious mutations in the genome of closely related, free-living bacteria

15. Number of eggs produced by the beetle *Stator* on Acacia — Number of eggs produced by the beetle *Stator* on Palo Verde

16. Size of eggs produced by the beetle *Stator* on Acacia — Size of eggs produced by the beetle *Stator* on Palo Verde

Answer each of the following questions:
18. Explain why trematodes that infest a certain snail species select for sexual reproduction in the snail host species when trematode infestations increase. (Remember, the trematodes eat the gonads of the snails, and the snails can reproduce asexually or sexually). (4 pts.)

19. Explain the one well-studied example of altruism between non-kin (besides humans) in the animal world, and the potential reason why this may actually occur from an evolutionary standpoint. (6 pts.)

20. Explain under what evolutionary circumstances the following should occur: (10 pts.)
(I understand that for ALL questions, you could simply say “when the specific phenomenon increases the fitness of the individual”. That is NOT what I am looking for. I’m looking for the circumstances under which the individual’s fitness WOULD increase if the individual exhibited the following phenomena.)

a. infanticide (2 pts.)

b. development of a potentially “expensive” mate attracting characteristic (brilliant color, long tail, fancy dance, etc.) (3 pts.)

c. siblicide (2 pts.)

d. give an example of an organism where siblicide seems common, and the difficulty in explaining why this occurs as commonly as it does in this organism. (3 pts.)

21. Discuss one animal and one plant example of males being able to monopolize a particular female’s reproductive output, thereby maximizing the males’ potential fitness. (8 pts.)
22. (2 pts.) Real data from my dissertation: Having measured the size and recorded the complement of defenses, it is found that large species exhibit reflexive bleeding, exhibit visual displays, but don't generally produce defensive sounds easily; small species on the other hand, don't reflexively bleed, fly quickly (or drop) upon being disturbed, but produce significant defensive sounds.

Circle the scenario ("a" or "b") that more robustly supports the following hypothesis:

"Body size is a strong ecological determinant of the complement of defensive mechanisms in adult Tiger Moths (Arctiidae)"

a. Most large Tiger Moths are closely related to each other and on the same branch of the phylogeny, and most small species are on the other branch of the phylogeny

b. Large species and small species are scattered throughout the phylogeny

Extra credit: Pick one of the following.

1. Explain the only two ways that an asexually reproducing organism can "fix" the problem of a deleterious (but non-fatal) mutation in the long run. I understand perfectly well that "reproducing sexually" would "fix" the problem, but assume the organism is exclusively asexual. (2 pts.)

2. Explain why Great Tits don't lay the number of eggs predicted by Lack's hypothesis in a given year. (3 pts.)