I. Short Answer Questions (4-9 points each) DO ALL QUESTIONS

SAQ #1. Please state and briefly explain the three major objectives of this course (listed on page two
          of the syllabus).
          state and explain objective 1 -   (3 pts)
          state and explain objective 2 -   (3 pts)
          state and explain objective 3 -   (3 pts)

SAQ #2. Although the use of cellular telephones has revolutionized the telecommunications industry,
          there is much concern that the strong electromagnetic fields that these phone generate pose a
          direct health risk to the brains of unsuspecting users.

   In the figure at right appears a vague but
     statistically significant relationship
     between hours of cell phone use and
     the rate of brain cancer by cell phone
     users. What is your response to the
     newspaper reporter who said that this
     showed that "cell phones cause brain
     cancer"?
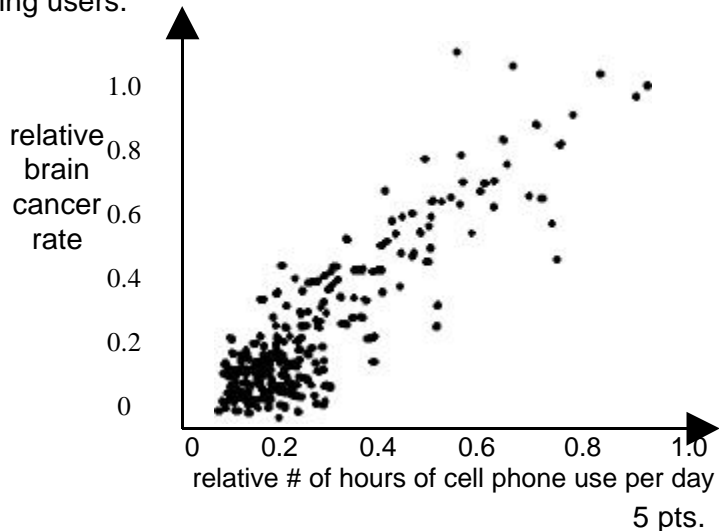
   Please BRIEFLY explain (in 2-3 sentences) -
     How **valid** is this conclusion?

                                                                                              5 pts.

SAQ #3. Please briefly explain what is "multiple causality," and why the problem of "multiple causality"
          makes it so difficult to apply the standard hypothetico-deductive process discussed in class to
          research questions in evolutionary ecology.

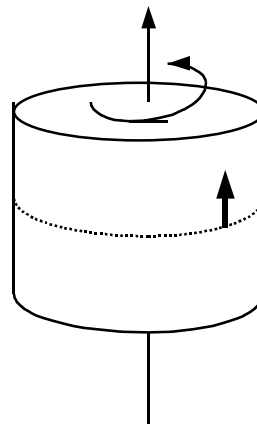   5 pts.

SAQ #4. According to many analyses, the biodiversity of the natural world is threatened and greatly
          undervalued. Please list some of the major market values (i.e., ecosystem services and utility)
          and non-market values that biodiversity provides?
          major market values: 3 pts.
          major non-market values: 3 pts.

SAQ #5. This question will test your understanding of the
          coriolis effect. If the Earth were a perfect cylinder
          rotating exactly on its cylindrical axis (see sketch),
          would there be a deflection of a n**orthbound** air mass
          starting at the equator, and if so, would it deflect to its
          left or its right?
                          Please briefly explain WHY.

                                                                                              5 pts.

SAQ #6. Please list the principal strengths and weaknesses of **"natural experiments"** to understand
          ecological phenomena. (please avoid unnecessary repetition)
          strengths: weaknesses:
                                                                                              4 pts.

Please diagram and label the two basic "functional characteristics", i.e. energy flow and biogeochemical cycling, of an ecosystem. In addition to your diagram, please also write somewhere on the page what are the basic differences between the paths of energy and biogeochemicals in an ecosystem, i.e. highlight the unique differences between them. (Please OMIT OMNIVORES for simplicity)

SAQ #7. functional characteristic 1: energy flow -

5 pts.

SAQ #8. functional characteristic 2: biogeochemical cycling -

5 pts.

SAQ #9. This question will assess your understanding of ecological energy flow (please refer to the figure "Energy Flow Diagram for a Georgia Salt Marsh "on the previous page).

(a). Net primary productivity (which is defined as gross productivity minus metabolic expenditure) for this ecosystem is numerically equal to what?

2 pts

(b). The ecological efficiency of net primary productivity for this ecosystem is numerically equal to what?

2 pts

(c). The ecological efficiency of "insects" for this ecosystem is numerically equal to what?

2 pts

SAQ #10. How might the problem of temporal or time scale pose a challenge to the accuracy and usefulness of this salt marsh ecosystem model? Please briefly speculate.

5 pts.

SAQ #11. How might the problem of spatial scale pose a challenge to the accuracy and usefulness of this salt marsh ecosystem model? Please briefly speculate.

5 pts.

SAQ #12. Data from a census of tree species include 80 trees of species A, 60 of species B, and 20 each of species C, D and E (note that the total number of species is 5 and the total of individuals is 200). The equation for the Shannon Diversity Index, H',

$$H' = -\sum_i^S p_i * \ln(p_i)$$

(for which p_i is the proportion of data from the ith species, and S is the total number of species)

...what is the diversity of species present? Please set up the problem, i.e. write out the equation for the diversity for these data, plug in all of the numbers, but do not bother further.

(5 pts)

SAQ #13. Please write in the spaces below what are the five environmental types that directly affect the day to day lives of individual organisms?

(5 pts)
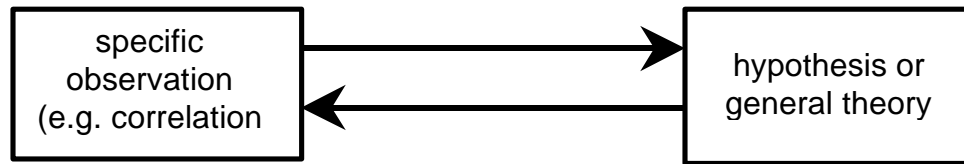
I. Longer Answer Questions (10 points each)

LAQ #1.   Please briefly explain the key differences between Inductive and Deductive reasoning in the scientific method. In addition, **please use the figure below** to illustrate your explanation.

10 pts.

LAQ #2. Why is there a distinct **dry season** in December-February in tropical regions centered at about 10° North latitude? Please use a clear diagram or set of diagrams. (hint: during June-Aug the dry season occurs at 10° South latitude...)
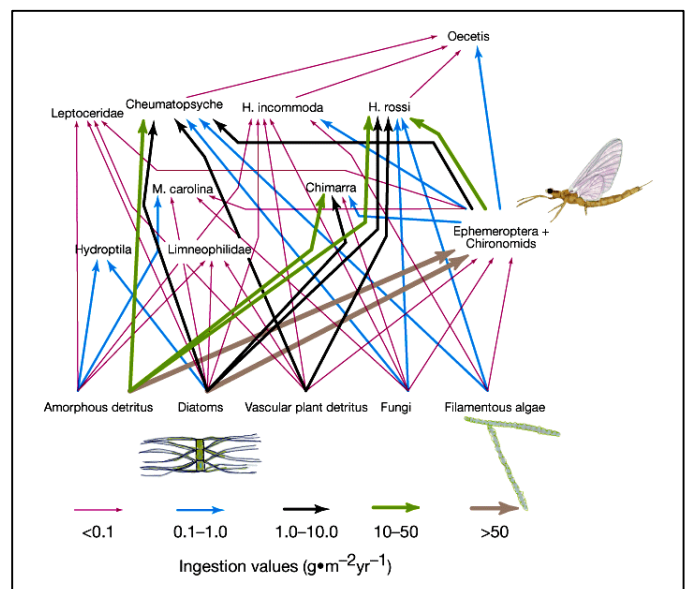
10 pts.

LAQ #3. This question will assess your understanding of the categories of major challenges to ecosystem modeling that we discussed in class (spatial, temporal, taxonomic, and other).

Consider the food web diagram at right (Stiling Fig 20.6 – Alabama stream ecosystem). Note that the line thicknesses represent the relative amount of energy flowing along each link (data from food ingestion rates).

According to Stiling, why is it important to consider these differences in feeding rates in modeling the trophic dynamics of the ecosystem? Please discuss the issues that would arise if one did and/or did not know these relative "interaction strengths."

I encourage you to use diagrams in your response.

10 pts.

LAQ #4. This question will assess your understanding of the
    categories of major challenges to ecosystem modeling that we
    discussed in class (spatial, temporal, taxonomic, and other).

    Consider the case of a carnivorous plant (such as a
    pitcher plant) at right. How would one's ecosystem
    diagram handle the situation if this plant's pollinator were
    one of the flying insect species that was trapped and
    consumed by the pitcher plant?

    Please discuss the issues that would now arise. I
    encourage you to use diagrams in your response.

LAQ #5. Please state what are the two principal objectives of individual ecology.
        state objective 1 -   (3 pts)
        state objective 2 -   (3 pts)
        How can the study of individual ecology contribute to an understanding of one of the major
        challenges to ecosystems modeling – spatial scale? Discuss exactly how individual ecology can
        contribute to an understanding of the "spatial scale" challenge to ecosystem modeling?
                                                                                                                    (4 pts)