 Name _____

Integrative Biology 200B Spring 2005

"PRINCIPLES OF PHYLOGENETICS: ECOLOGY AND EVOLUTION"

Quiz 1

1. (20 points -- answer only 4 of these 5 -- your choice) Briefly describe the following concepts; giving the most important and/or controversial points, and the assumptions that must be made

a. the relationship between phylogenetics & conservation?

b. phylogenetic constraints

c. concentrated change test (Maddison's test)

d. codon usage bias

e. rank-free classification

2. ((20 points -- answer only 4 of these 5 -- your choice) Briefly contrast the following pairs of

terms (Use diagrams if they help):

a. Parsimony vs. maximum likelihood reconstruction of ancestral states (you can just consider discrete traits in your answer)

b. Linear vs. squared change parsimony

c. paralogy vs orthology

d. neoteny vs. progenesis

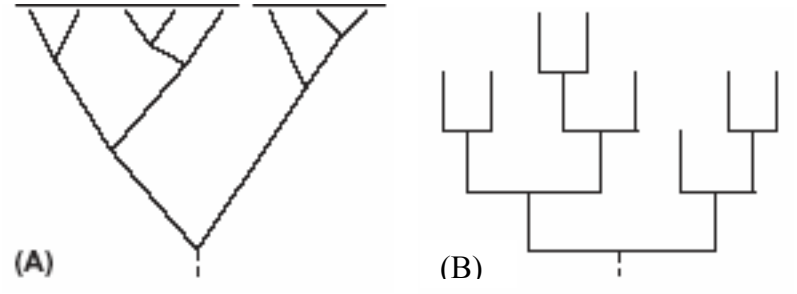
e. adaptation vs. exaptation

3. Short answers **(20 points)**:

a. Assume that a trait evolves by Brownian motion on the two trees below (next page). In your own words, how would you describe the pattern of trait evolution, and how does it differ between the two trees?

(A) Branch lengths proportional to time

(B) All branch lengths equal (terminal taxa are extant)



b. A simple measure of conservatism for a binary trait is the number of reconstructed changes on a tree. How can the significance of this number be tested? What is the underlying null hypothesis?

c. When using parsimony to reconstruct ancestral states of discrete characters, why does it matter how you optimize transformations on the cladogram? What can make optimization equivocal?

d. Describe the components of a maximum likelihood analysis and the likelihood ratio test for comparing alternative hypotheses.

4. (15 points) What sort of comparative method or approach would you apply to the following evolutionary questions (e.g., what assumptions would you make, what kind of data would you require, how would you generate a null hypothesis, how would you judge statistical significance?):

a. Are fleshy-fruited plants more likely to evolve a dioecious condition (i.e., separate sexes on different individuals)?

b. Is leg length correlated with running speed in ungulates?

c. Is there a trend towards increasing body size within lineages of mammals (Cope's Rule)?

[Bonus: 5 points extra credit] *Flowerella*, a clade with 75 species, exhibits considerable interspecific diversity in flower size, and species are pollinated by one of three vectors: bees, bats and hummingbirds. Thanks to your colleagues in the herbarium, you have an excellent, fully resolved phylogeny for the group. How could you go about constructing a comparative test of the hypothesis that flower size evolves in association with shifts in pollination mode?

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