The total variation in phenotype is equal to:

a) genotype plus the environment
*b) the genetic variance plus the environmental variance
c) the deviations from the population mean
d) the standard deviation of the additive variance
e) the number of genes which contribute to the trait

Size in guppies is controlled by two loci, A and B. All alleles at these loci are codominant. Which of the following populations will have the greatest additive genetic variance for size?

a) $A_1 = A_2 = B_1 = B_2 = 0.5$ b) $A_1 = B_2 = 0.7$, $B_1 = A_2 = 0.3$ c) $A_1 = B_1 = 0.6$, $A_2 = B_2 = 0.4$
*d) $A_1 = A_2 = A_3 = B_1 = B_2 = B_3 = 0.333$ e) $A_1 = A_2 = B_1 = B_2 = 0.25$, $A_3 = B_3 = 0.5$

Disruptive selection on a quantitative character:

a) changes the mean and increases the variance
b) changes the mean but not the variance
c) doesn't change the mean and reduces the variance
*d) doesn't change the mean and increases the variance
e) doesn't change the mean or the variance

In the following phylogenetic tree, we have body size and lifespan measurements for each species. To gather evidence for our hypothesis that increased body size leads to increased lifespan, we are interested in measuring the relation between the two. How many possible phylogenetically independent contrasts are we able to make?

Male-male competition is likely to be most intense when

a) males contribute to parental care
*b) males may have multiple mates
c) males provide substantial resources to females
d) males can guard territories
e) males have large weapons

Reciprocal altruism differs from altruism because

a) altruistic acts need not be distributed to kin
b) the payoff comes when "favors" are returned
c) failure to reciprocate is punished.
*d) all of the above
e) none of the above

Phylogenetic analysis can be used for:

a) determining which species are most closely related
b) determining cospeciation
c) determining patterns of adaptive evolution
*d) all of the above
e) none of the above

What is the best way to initially evaluate multiple equally parsimonious trees?

*a) bootstrapping
b) jackknifing
c) add more taxa
d) add more characters
e) chi-square test

Although mimicry often involves a palatable mimic and a poisonous model, in parts of South America several species of poisonous butterflies have evolved to resemble each other. One particular pair of species, *Heliconius melpomene* and *Heliconius erato*, displays considerable geographic variation over the entire range of the species. But at any specific location, the two species closely resemble each other (i.e., at a given site individuals of *H. erato* and *H. melpomene* will more closely look like each other than two populations of *H. erato* from different areas). Color pattern is determined by 8-12 different genes which are not closely linked. In the lab, you can cross individuals of the same species from different populations and produce viable progeny. These F1 hybrids have a color pattern that resembles that of one of the H. erato parents. When you cross the F1 offspring, the F2 offspring have a much higher diversity of wing patterns, including mixtures of the two species. Such unusual phenotypes are almost never observed in the field.

To test one of the adaptive hypotheses, you decide to conduct a field experiment that manipulates the wing color pattern. You collect butterflies, give each a small mark that indicates they have been captured, and then color the wings. Which of the following would <u>not</u> be necessary?

a) artificially coloring hybrids to resemble parental phenotypes
b) artificially coloring parental phenotypes to resemble hybrids
*c) artificially coloring parents to create novel phenotypes (don't resemble hybrids)
d) artificially coloring parental phenotypes and hybrids with clear marker that doesn't change pattern
e) catching, marking and releasing hybrid and parental phenotypes

After a winter storm, you find a large number of stink bugs along the shore of Lake Houston. Many of the bugs are dead, but some are still alive. You collect a large sample of both living and dead individuals and make several morphological measurements to determine whether surviving bugs differ from ones that died. The traits you measure are illustrated in the figure below. After measuring, you perform multiple regression analysis to determine the relationship between fitness and morphology, if any. Your results are the selection differentials and selection gradients shown below (asterisks indicate significant differentials or gradients).

trait	s	B
Head width	+0.29*	-0.18
Pronotum width	+0.41**	+0.27*
Wing length	+0.17	+0.32*
Antenna length	+0.11	+0.09

Which of the following statements best describes bugs that survived the storm.

a) they have wider heads, a wider pronotum, longer wings and longer antennae
b) they have narrower heads, a wider pronotum, longer wings, and longer antennae
*c) they have wider heads, a wider pronotum, but do not differ in wing or antenna length
d) they have a wider pronotum, longer wings, but do not differ in head width or antenna length
e) they have narrower heads, a narrower pronotum, shorter wings, and shorter antennae

Which of the following statements is most likely to be true?

a) selection changed the phenotypic distribution of all four traits in the population
b) selection increased the average head width and pronotum width in the population
*c) selection increased the average pronotum width and wing length in the population
d) selection did not change head width in the population
e) selection decreased average head width in the population

Which of the following statements is most likely to be false?

a) pronotum width and wing length are positively genetically correlated
*b) head width and pronotum width are negatively genetically correlated
c) head width, pronotum width, wing length and antenna length are positively phenotypically correlated
d) head width, pronotum width, wing length and antenna length are positively genetically correlated
e) head width, pronotum width, wing length and antenna length are positively environmentally correlated

Male redwing blackbirds that are sexually mature have a bright red shoulder patch. In Washington State, males arrive at breeding sites (marshes) before females and compete with other males for territories. Males without territories will not breed successfully. Females arrive after the males have established territories and choose a male with which to mate. Only females take care of the young, and they forage on the male's territory for food. In the closely related tricolored blackbird, where males also have red patches, males do not maintain territories. (Other related species of blackbirds lack the red patch entirely.) Both female redwings and female tricolors prefer to mate with conspecific males that have largest red patches.

Which of the following statements is most likely to be true?

*a) Female redwings choose mates to obtain direct benefits
b) Female redwings choose mates to obtain high quality offspring
c) Female redwings choose mates to obtain more attractive sons
d) Female redwings choose mates because of an innate bias for red
e) Female redwings choose mates to mate with the fittest male

Which of the following statements is most likely to be <u>false</u>?

*a) Female tricolors choose mates to obtain direct benefits
b) Female tricolors choose mates to obtain high quality offspring
c) Female tricolors choose mates to obtain more attractive sons
d) Female tricolors choose mates because of an innate bias for red
e) The red shoulder patch of a tricolor male is an honest signal

Based only on the information given in the question, you would expect:

a) Genetic covariation between female preference and male color in Redwings only
*b) Genetic covariation between female preference and male color in Tricolors only
c) Genetic covariation between female preference and male color in both Redwings and Tricolors
d) No genetic correlation between female preference and male color in either species
e) The red shoulder patch of a tricolor male is not an honest signal