EXAM **BSC 3402L** **Spring 2004**

Name_____KEY_____

Be sure to read each question carefully and answer completely.

Use the diagram of a floral cross section above to answer the following questions (3 points each):

1. What is the name of the part labeled d? ___style_____
2. What is the collective term for the parts labeled c and e? __stamen____
3. Which is the structure that releases pollen? __c (or anther)_____
4. List the letters that designate parts of the pistil? a, d, and g (f ok, not required)
5. Is this a perfect flower AND how can you tell?

This is a perfect flower because it has both male and female reproductive parts

Definitions (4 points each)

Define each of the following (as used in class or in the text) briefly but **completely**. REMEMBER never to use the word itself in the definition and not to give an example rather than a definition.

6. Foraging - behavior used in acquiring resources

7. Self-incompatibility – inability of pollen to fertilize ovules produced by the same individual

8. Student's t-test – statistical procedure used to compare two means

9. Pollination syndrome – set of floral traits shared by different species that use the same pollen vector

10. Hypothesis – proposed explanation for a phenomenon

Short answer (5 pt each)

11. Briefly describe one advantage and one disadvantage to self-pollination.

Advantages: No need for a mate (colonization)
Transmission of 2 copies of genome per offspring
Preserves "proven" genotypes
Reproductive assurance

Disadvantages: Inbreeding depression is possible
Reduces genetic variation

12. Briefly describe a pollination syndrome in which no reward is provided.

Wind or water pollination
Pollination mimics – e.g. pseudo-copulatory orchids, fungus mimics
Traps – e.g. bucket orchids

13. While walking to school one morning, you discover a new species of flowering plant. It has medium-sized, yellow, bowl-shaped flowers, and under ultraviolet light you can see dark lines radiating out from the center of the flower. It produces some pollen but no nectar, and has a minty odor. Explain how you could use the floral characteristics of this plant to eliminate two biotic pollen vectors as likely pollinators for this species.

Absence of nectar rules out birds and bats (does NOT rule out bees)

UV markings rule out birds and bats

Opening during day rules out bats and most moths

Minty odor makes flies unlikely

Yellow makes hummingbirds unlikely

Flat shape rules out moths and butterflies

14. What is the relationship between observation, hypothesis and experiment in the scientific method (use words, not a diagram)?

Hypotheses are constructed to explain observations, and experiments are tests of hypotheses.

15. Consider a butterfly that has just entered a meadow filled with different flowering plant species. Assuming that the butterfly will visit only one species and **will apply the rules of optimal foraging** to make its choice, describe three factors that will affect which species it chooses.

Quantity of reward offered
Quality of reward offered
Distance between individuals (density is the same thing)
Handling time of the flowers
Presence of competitors or predators

Experimental Scenarios

16. You come across a field containing many different species of plants, all with tubular flowers. You wish to know if there is a relationship between flower color and the depth of the flower tube. You've forgotten your ruler, so you classify the flowers of each species as shallow, medium, or deep. (3 pt for each part)

a. State appropriate null and alternative hypothesis for your question?

Null: Flower depth is independent of color

Alternative: Flower depth depends on color

b. For each variable you will measure, tell whether the data will be discrete or continuous AND whether it is ordinal or nominal?

Flower color – discrete, nominal

Flower tube size – discrete, ordinal

c. What statistical procedure will you use to analyze your data and test your hypothesis? Chi-square test of independence

d. Describe how you will use your calculated test statistic and the critical value to decide whether to reject your null hypothesis.

If calculated value is greater than critical value, then reject the null hypothesis

17. A pollination biologist suspects that leaf damage due to insect feeding reduces the attractiveness of plants to pollinators. To test his hypothesis, he finds a patch of plants where the leaves have been damaged and a second patch with undamaged leaves. He counts the total number of visitors to each of the two patches over one four hour period and proposes to compare mean visit number between the two patches using a t-test.

a. There are at least two problems with the design of this study (it lacks some of the essential elements of experimental design) and one with the proposed analysis (if you're stuck here, think about how you would calculate the numbers you need for this analysis). Briefly describe each of these (10 pt).

Design: The study lacks replication because there is only one patch per treatment (therefore it also lacks randomization)

The study is observational rather than experimental.

Analysis: There will be only one number of visits for each patch, and you cannot calculate a t-value without variance.

b. For each problem you identified in part a, describe how the biologist could either avoid or fix the problem (10 pt).

The lack of replication can be fixed by using more than one patch per damage type. The study can be made experimental by starting with only undamaged plants and having the biologist apply the damage artificially to only some patches, leaving others as controls.

The analysis can be a t-test once there is replication, or a Chi-square goodness of fit to a 1:1 ratio could be used.

18. A biologist wishes to test the hypothesis that the dogwood trees on the FSU campus produce more flowers if they grow on the east side of Woodward Avenue than if they grow on the west side of the street. He randomly selects 25 trees on each side of the street and counts every flower produced on each of these fifty trees. (2 points each)

a. What constitutes the **population** that the biologist is interested in?

All the dogwood trees on the FSU campus

b. What constitutes a **sample** in this study?

The trees measured by the biologist

c. Name a **variable** that will be measured.

The number of flowers produced

d. What would constitute one **observation** in this study?

The number of flowers on one tree that was measured