Answers to Practice Problems BSC 3402L Spring-2004

1a. H_o: Bees visit all flower colors with equal frequency
H_a: Bees visit some flower colors more (or less) frequently than others

b. Count the number of visits to each flower color
c. use a Chi-square goodness of fit to test the observed frequency against an expected 1:1:1:1 frequency

d. Chi-square = $\sum$ (observed - expected)^2/expected

$$= \frac{(25 - 50)^2}{50} + \frac{(86 - 50)^2}{50} + \frac{(50 - 50)^2}{50} + \frac{(39 - 50)^2}{50}$$

degrees of freedom = (4-1)

2a. H_o: Birds and bees fly equal distances between visits
H_a: The average distance flown between visits by birds is greater than that for bees

b. Follow a number of birds and bees around and measure the distances they fly between successive visits to flowers

c. observational
d. t-test comparing the average distance between visits for birds and bees

3a. The average distance between flowers of the same species as an estimate of search cost and the average reward in each flower as a measure of benefit.
b. The ratio of benefits to costs for a pollinator foraging on each species
c. An optimal forager would chose whichever species provided a greater ratio of benefits to costs.

4a. Solar tracking class is discrete ordinal, temperature is a continuous variable
b. H_o: There is no effect of tracking class on temperature
H_a: As tracking ability increases, temperature increases too.
c. linear regression. Tracking class would be the independent variable and temperature would be the dependent variable.
d. Randomly assign plants to two groups; the treatment group would be tethered to prevent solar tracking and a second group, the controls, would be allowed to track. Use a t-test to compare the average temperature of the tethered flowers with the controls.

5 a. The figure should be a histogram showing the percent of visits to sweet (or skunky) flowers for each of the three pollinator types

b. H_o: All pollinators have the same scent preferences (and therefore each has the same frequency of visits to particular scents as all other pollinators.
H_a: Different pollinators show different preferences for flower scent (therefore the frequency of visits to scent types differs among the pollinators)

c. χ^2 contingency test of independence between pollinator type and flower scent.
d. Science never "proves" anything. The scientist should accept his null hypothesis.

e. Observe and mark flowers visited by each pollinator and determine the number of seeds set by the flowers.
f. Report mean and variance of seed number for flowers pollinated by each type of pollinator.
g. Measure the height of plants that are and are not visited by pollinators. Or measure the height of plants that are visited and the heights of a random sample of plants from the population.
h. Height is a continuous variable because its units are infinitely divisible.
i. A t-test comparing mean height of visited and non-visited (or visited and the random sample).
j. Compare the calculated t with the critical t for probability = .05 and the correct degrees of freedom. If t-calculated is less than or equal to t-critical, he should accept the null hypothesis. If t-calculated > t-critical, he should reject his null hypothesis.