

1. Briefly answer the following:

- When a data set is not normally distributed, what should you try in order to appropriately make statistical tests on that data?
- Why are paired samples analyzed differently than separate samples?
- What are the non-parametric alternatives to

ANOVA

2-sample t-test

correlation

2. Scorpionfly males were raised on either a high nutrient (NH) or low nutrient (NL) food, to test the prediction that bad conditions causes more developmental problems (as measured by asymmetric development). Their wings were then measured on both sides, and the absolute value of the difference between the left wing length and the right wing length was used as a measure of their asymmetry (X_i). The results were as follows:

	sample size	$\sum X_i$	$\sum X_i^2$
NH males	29	0.9744	0.0427
NL males	34	1.8598	0.1727

Do the appropriate test of the hypothesis, making the necessary assumptions.

3. In Vancouver, the probability of rain during a winter day is 0.58, for a spring day 0.38, for a summer day 0.25, and in fall the probability of rain per day is 0.53. Each of these seasons lasts one quarter of the year.

- What is the probability of rain per day in Vancouver?
- If you are told that a particular day was raining, what is the probability that that day was a winter day?

4. A cross of two duck species (mallards and pintails) was made to investigate the behavioral patterns of hybrids. A behavioural index was calculated for each of 11 male F2 hybrids, and a plumage index (to measure the condition of their feathers) was also calculated for each of the birds. Are the behavioral and plumage indices independent? Make, and state, any necessary assumptions.

Male	Plumage Index	Behavioral Index
R	7	3
S	13	10
D	14	11
F	6	5
W	14	15
K	15	15
U	4	7
O	8	10
V	7	4
J	9	9
L	14	11

$$\sum P = 111$$

$$\sum P^2 = 1277$$

$$\sum B = 100$$

$$\sum B^2 = 1072$$

$$\sum PB = 1141$$

5. What is the best statistical technique for dealing with the following situations and questions? Be as specific as possible (i.e. “multivariate ANOVA” is a better answer than “ANOVA,” if it is a more appropriate technique.)

A. Are the nucleotides used in 2 regions of DNA composed of the same proportions of A, T, C and G?

B. Do grades on homework assignments predict final exam grades?

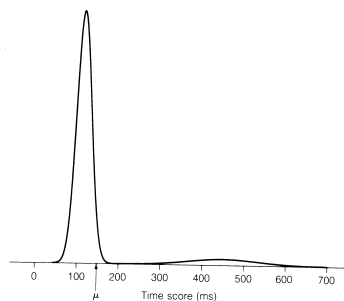
D. In humans, is hair length different on average between the sexes? (Assume normality and that the variance of hair length is equal.)

E. Re-answer D., if the distributions were not normal.

F. Data on 412 married couples recorded the amount of weight gain in 10 years after marriage. Is there a difference in weight gain after marriage in men relative to women?

G. This graph presents the distribution of time required to push a button after a stimulus. Comparing 7 different groups, are all groups the same in their average button-pushing times?

FIGURE 5.14
Distribution of Time
Scores in a Button-
Pushing Task



H. Is the number of chirps per hour of calling birds normally distributed?

I. A study compared the effects of 5 soil types and 6 different fertilizers on corn growth rate. Is the effect of soil type independent of the effect of fertilizer type?

J. Do men and women have the same variance of final grade averages (if final grades are normally distributed within sexes)?

6. A biological statistics class was given a test. Immediately after the test was completed, each student was asked if she or he felt better or worse than before they took the test. Ten reported feeling better, and two felt worse. Using this sample of twelve students, does taking stats exams change the average mood of students?

7. Monoamine oxidase (MAO) is an enzyme that is thought to play a role in the regulation of behavior. To see whether different categories of schizophrenic patients have different levels of MAO activity, researchers collected blood specimens from 42 patients and measured the MAO activity in the platelets. The means and standard deviations of each group are summarized below. (Values are expressed as nmol benzylaldehyde product/ 10^8 platelets/hour.) Construct the ANOVA table and test whether these behavioral categories have any differences in MAO activity. Assume that MAO activity is normally distributed and that each of these groups has equal variance in MAO activity.

Diagnosis	Mean MAO Activity	SD MAO Activity	No. of patients
Chronic undifferentiated schizophrenic	9.81	3.62	18
Undifferentiated with paranoid features	6.28	2.88	16
Paranoid schizophrenic	5.97	3.19	8

8. List the assumptions of the following tests

- a. Paired t-test
- b. Mann-Whitney U test
- c. Linear regression
- d. ANOVA