Statistics: Chapter 11 Solutions

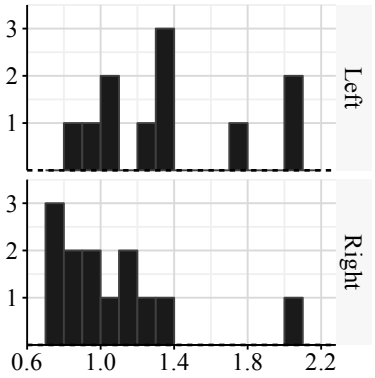
Lesson 11.1.1

11-1. a. Explanatory: hand. Response: reaction time.

b. Left hand, right hand

c. It is a completely randomized design, but the randomization is done in such a way that sample sizes are not guaranteed to be equal.

d. Answer will depend on data. Sample data (seconds): Left: 0.94, 1.039, 1.751, 2.067, 1.303, 1.255, 0.882, 1.081, 1.303, 1.366, 2.086; Right: 0.835, 0.762, 1.389, 0.895, 1.028, 1.133, 1.173, 0.919, 0.996, 1.235, 2.095, 2.095, 0.796, 0.785. Mean of left = 1.370, sd of left = 0.422, mean of right = 1.080, sd of right = 0.3611. See histograms at right.



e. Answers will vary. Generally there is some difference, but it is not always very large.

f. These are independent samples.

g. If the *p*-value is greater than 0.05 (as it is in the sample data, with a *p*-value of 0.088) then the conclusion is "Because the *p*-value > 0.05 (α), you do not have statistically significant evidence that the true average reaction time for the left hand differs from that of the right hand." If the *p*-value is less than 0.05, then a good conclusion is "Since *p*-value < 0.05 (α) you can conclude that there is a statistically significant difference between the true reaction time for the left hand and the right hand in this group."

11-2. a. There are three main differences. First, the start button has been moved to the center of the click area and the squares have been equally spaced around the button. This could improve the data if the distance from the start button was a confounding variable before. Second, the explanatory variable domain is no longer "left" and "right" but is now "dominant" and "non-dominant", which will remove the confounding variable of hand dominance. Finally, the experiment is now done in a matched-pairs style, so every participant does both treatments (in a random order). This should help reduce variability in the data.

b. Answers will vary. It is generally more likely that the *p*-value will be < α in this experiment than in the previous experiment, or at least will have a lower *p*-value. In that case, the correct conclusion is "the experiment found statistically significant evidence that the reaction time of the dominant hand is generally lower than the reaction time in the non-dominant hand."

11-3. a. paired data

b. independent samples

c. independent samples

d. paired data

11-4. a. mean = –8, sd = 4 b. mean = –1, sd = 2

c. mean = 12, sd = 3 d. mean = 0, sd = 3

e. mean = 0, sd = $\sqrt{5}$ f. mean = 16, sd = 5

11-5. a. Randomly assign half of his playes to drink CrocodileAde and the other half to drink water (or some sort of placebo). Then have everybody run the 100 m dash. Calculate the average time of the CrocodileAde group and compare it to the average time of the water group.

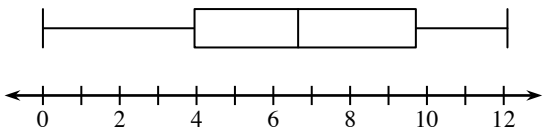
b. Randomly assign half of his players water and half of his players CrocodileAde, then measure their 100 m dash times. Wait a day (or a week) and repeat the process, with each player switching drinks. Calculate the difference between the water and CrocodileAde time for each person, then examine the average difference and see if it is not zero.

c. There is much more variability in the completely randomized design—since running times differ significantly, a slight improvement in individuals may be drowned out by simple random luck of having faster people in the water group. The matched pairs design accounts for that variability by comparing fast individuals to themselves.

11-6. Identify: σ is unknown so use a one-sample t-interval.
Check conditions: Random selection, to avoid bias—given in problem. Independent trials, for an accurate σ—assumed that the population of pellets is many many times larger than 10. Large sample, so the sampling distribution is ≈ normal—the sample size is not larger than 30, however the t-distribution can be used if there is no evidence of strong outliers or skewing in the sample. A boxplot of the sample data (below) shows neither.
Calculate: $\bar{x} = 6.76$ g, $s = 3.824$ g, df = 9, $t^* = 2.8214$, $\bar{x} \pm t^* \cdot \frac{s}{\sqrt{n}}$,

$6.76 \pm (2.8214)\left(\frac{3.824}{\sqrt{10}}\right) = 6.76 \pm 3.41.$

Conclude: You can be 98% confident that the true mean mass of rodent bones in this population of hawks is between 3.35 and 10.17 grams.



11-7. C, the circle graphs are the only option listed for categorical data.

