Statistics: Chapter 12 Solutions

Lesson 12.1.1

12-1. a. For each additional inch of rainfall, the predicted weight of coffee produced increases by about 0.06 pounds.

b. $r = \sqrt{0.9157} \approx 0.957$. Students can confirm that it is positive because the slope of the regression equation is positive. There appears to be a strong, positive, linear relationship between the weight of coffee produced and the amount of rainfall.

12-2. a. Each study was conducted based on a random sample from the population. There is natural sample-to-sample variability for any statistic.

b. Both slopes are currently around 0.06 and do not differ too much. A reasonable answer might be something like 0.052 to 0.068.

c. If many many studies were conducted like this, you could record the slope each time. These values would all be naturally different because the data comes from a random sample. Therefore, the slope of the regression equation has a distribution.

12-3. a. The slopes appear to be centered about a mean of 0.05983 lbs/in with a standard deviation of 0.00125 lbs/in. A histogram appears mostly symmetric.

b. The standard deviation from our 12 slopes was 0.00125 lbs/in. Based on this, students might guess that typical slopes are within 0.00125 lbs/in of the population parameter β.

c. The standard error of the slope (0.0012) is very close to the standard deviation students found (0.00125). If repeated studies are conducted, students expect typical slopes to be within about 0.0012 lbs/in of the "true slope" for the population.

12-4. a. Yes, it was stated that the coffee plants were randomly gathered from a population of coffee plants.

b. Students can assume that the population of coffee plants is much larger than the samples used in the study.

c. It seems plausible that for each level of rainfall randomly assigned, the weight of coffee beans produced could be normally distributed with similar standard deviations. The residual plot being completely random also indicates that the residuals have a consistent spread.

d. Yes, it was stated that a residual plot was completely random.

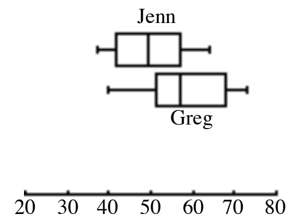
12-5. a. One of the column headers is "T."

b. Two points determine a line. Anything beyond these two points would be "free to vary." The degree of freedom is $n - 2$.

12-6. a. Quantitative, the data represents measurements of time in minutes.

b. Identify: Let $\alpha = 0.05$, hypotheses: H_0: $\mu_g - \mu_j = 0$, H_A: $\mu_g - \mu_j > 0$ where μ_g is the population mean time Greg uses the computer daily and μ_j is the population mean time of Jenn's computer usage. Sample evidence for H_A: $\mu_g - \mu_j = 6.714$ minutes.

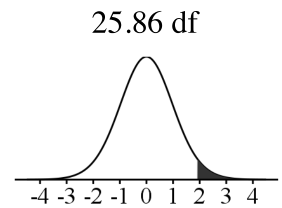
Check conditions: Samples are independent, not paired. Random—given in problem. Large sample—assume that there are more than $n \cdot 10 = 140$ days of computer usage in each population. Normal population—the sample sizes are not larger than 30 so a check of the boxplots from each sample shows no strong skewing or outliers.



Calculate: $\bar{x}_d = 6.714$ minutes,

$s_d = \sqrt{\frac{9.621^2}{14} + \frac{8.939^2}{14}} = 3.510$; $t = \frac{6.714 - 0}{3.510} = 1.913$;

df = 25.86, p-value ≈ 0.0335.



Conclude: Reject H_0. Jenn has convincing evidence that Greg is using the computer more on average. However, being a "computer hog" still needs to be defined.

12-7. a. $\hat{y} = -10.23 + 0.3444x$, where: x is mass and $\hat{y}$ is predicted venom amount.

b. For every one gram increase in octopus mass the predicted value of its venom amount will increase by 0.3444 μL.

c. $\hat{y} = -10.23 + 0.3444(66.65) = 12.72$ μL

d. The predicted value at $x = 67.6$ g is $\hat{y} = -10.23 + 0.3444(67.6) = 13.05$ μL. The residual is $Y_{\text{observed}} - Y_{\text{predicted}}$. Residual = 12.5 – 13.05 = –0.55 μL

e. There is no discernable pattern in the residual plot confirming that a linear model is most appropriate.

12-8. a. $10000 \cdot 0.02 = 200$, so 9800 people do not have the condition.

b. $200 \cdot 0.99 = 198$

c. $200 \cdot 0.01 = 2$ false negatives

d. $9800 \cdot 0.01 = 98$ people

e. $98 + 198 = 296$

f. $\frac{198}{296} \approx 67\%$

g. The percent would drop to 50%.

