Lesson 10.3.3

10-56. a. Answers will vary.

b. It is most similar to a cluster sample, though it is not perfect since many words (the ones after the first 25 words per page) are not actually put into clusters. You could argue this is an example of potential undercoverage.

c. Answers will vary, but will usually have a fairly wide range. For example, one interval constructed with sample data resulted in the interval 5.48 ± 1.25. Make sure you used a t-distribution with 24 degrees of freedom. The interpretation should begin "we are 95% confident that the average word length is between…"

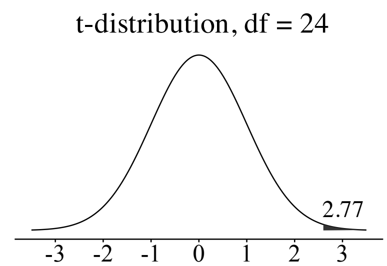
d. Again, answers will vary, but the larger sample size should result in a narrower confidence interval. Using sample data resulted in the interval 5.37 ± 0.7. Answers should be of the form "we are 95% confident that the average word length is between…"

e. Answers vary.

10-57. a. H_0: $\mu = 3.8$; H_A: $\mu > 3.8$ where μ is the average length of words in your book. Sample evidence will vary. Using the sample values from the previous answer, $\bar{x} = 5.48$ letters/word.

b. Answers will vary. The formula is $t = \frac{\bar{x}-3.8}{\frac{s}{\sqrt{25}}}$. Using the sample values from part (c) of problem 10-56, the t-statistic is 2.77.

c. The curve will look something like the one at right, but with a different t-value. The scale is unimportant.



d. The one-tailed p-value with the sample data is 0.004, so it is reasonable to conclude that this book has an average word length higher than that of *The Cat in the Hat*. Some books may not be able to reach such a conclusion with a sample size of only 25 words.

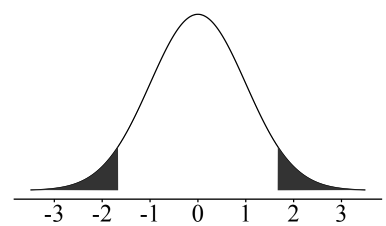
10-58. Identify: This is a two-tailed t-test for the population mean. H_0: $\mu = 2.78$. H_A: $\mu \neq 2.78$ where μ is the current average household size in Boone County. Use $\alpha = 0.05$. Sample evidence for H_A: $\bar{x} = 2.69$.

Check conditions: Random selection, to avoid bias—stated in problem. Independent trials, for an accurate σ—the population of Boone County (125,000) is much greater than $10 \cdot 100 = 1000$. Large sample, so the sampling distribution is ≈ normal—$n = 100 > 30$.

Calculate: The test-statistic is $t = \frac{2.69-2.78}{\frac{0.54}{\sqrt{100}}} \approx -1.67$. The p-value is the area of the shaded curve shown at right, about 0.098.

Conclude: since the p-value of $0.098 > \alpha$ of 0.05, you do not have sufficient evidence to conclude the average household size in Boone County has changed.

t-distribution, df = 99



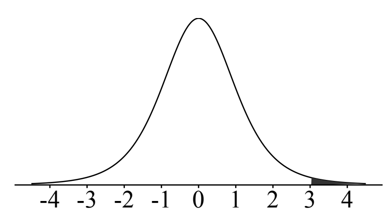
10-59. Identify: this is a one-sample t-test for the population mean. Hypotheses: H_0: $\mu = 4$, H_A: $\mu > 4$ where μ is defined as the average value of "a few." Sample evidence for H_A: $\bar{x} = 5.3889$ jellybeans.

Check: Random selection, to avoid bias—assumption confirms randomness. Independent trials for and accurate σ—the population of "students like them" is significantly larger than $10 \cdot 18$, or 180 people. Large sample, so the sampling distribution is ≈ normal—the dot plot shows no outliers and only moderate skew, with a sample size of 18 that should be satisfactorily normal.

Calculate: The t-value is $\frac{5.3889-4}{\frac{1.9445}{\sqrt{18}}} \approx 3.03$. On a t-distribution with 17 degrees of freedom, the one-tailed p-value is 0.004. See diagram at right.

Conclude: Since p-value $< \alpha$, Mo has convincing evidence at a significance level of 0.01 that Lana is wrong, and the average value of "a few" jellybeans is in fact greater than 4, amongst students like them.

t-distribution, df = 17



10-60. a. You can say with 95% confidence that the average spent by a family in Milwaukee on shoes is between \$453.91 and \$496.09.

b. The population mean is estimated to be within \$27.75 of our sample mean at 99% confidence.

c. The margin of error is $\frac{490-460}{2} = \$15$, Margin of error $= t\left(\frac{s}{\sqrt{n}}\right)$, $t = 15\left(\frac{\sqrt{500}}{240}\right) \approx 1.398$, $\alpha = 2 \cdot \text{tcdf}(1.398, 10^\wedge 99, 499) \approx 0.163$, confidence $= 1 - \alpha \approx 83.7\%$

10-61. a. $P(X < 44900) = \text{normalcdf}(-10^\wedge 99, 44900, 45000, 700) = 0.4432$

b. $P(X < 44900) = \text{normalcdf}(-10^\wedge 99, 44900, 45000, \frac{700}{\sqrt{64}}) = 0.1265$

c. $P(X < 44900) = \text{normalcdf}(-10^\wedge 99, 44900, 45000, \frac{700}{\sqrt{256}} = 0.0111$

10-62. a. Identify: Two-sample test of proportion. H_0: $p_1 = p_2$, H_A: $p_1 > p_2$, where p (1 = women, 2 = men) is the population proportion of women who respond to text messages while driving. $\alpha = 0.05$. Sample evidence for H_A: $0.67 > 0.62$.
Check: Large counts, so the sampling distribution is ≈ normal
$np = 252(0.62) > 10$, $n(1-p) = 252(0.38) > 10$, $np = 175(0.67) > 10$, $n(1-p) = 175(0.33) > 10$. Independent trials, for an accurate σ—population is larger than 4270. Random selection, to avoid bias—given.
Calculate: critical value = 1.645, test statistic 1.05, p-value = 0.1473.
Conclude: p-value > 0.05, Students cannot reject H_0 and are unable to demonstrate that a significantly higher proportion of women than men respond to texts while driving.

b. Identify: Two-sample test of proportion. H_0: $p_1 = p_2$, H_A: $p_1 \neq p_2$, where p(1 = women, 2 = men) is the population proportion who believe that using your phone while driving is the most dangerous. $\alpha = 0.05$. Sample evidence for H_A: $0.53 > 0.47$.
Check: Large counts, so the sampling distribution is ≈ normal
$np = 252(0.47) > 10$, $n(1-p) = 252(0.53) > 10$, $np = 175(0.53) > 10$, $n(1-p) = 175(0.47) > 10$. Independent trials, for an accurate σ—population is larger than 4270. Random selection, to avoid bias—given.
Calculate: critical value = 1.645, test statistic = 1.28, p-value = $2 \cdot 0.099 = 0.199$.
Conclude: p-value > 0.05, Students cannot reject H_0 and are unable to show that a different proportion of men than women agreed that using your phone is the most dangerous thing to do while driving.

