

Estimating Populations

Chapter 10 Quiz Review

Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

1. In an opinion poll, 25% of a random sample of 200 people said that they were strongly opposed to having a state lottery. The standard error of the sample proportion is approximately
(a) 0.0094 (b) 0.0306 (c) 0.0353 (d) 0.2500 (e) 6.1237

2. A marketing consultant wants to estimate the proportion of all shoppers at a certain mall who make at least one purchase. He stands at a mall exit for two hours on a weekday afternoon and flips a coin each time a shopper leaves. If the coin comes up heads, he asks them if they have made any purchases during this visit. After two hours, he has 132 responses, 104 of whom made a purchase.

Which condition for constructing a confidence interval for a proportion has the consultant failed to satisfy?

(a) $n\hat{p} \geq 10$

(b) $n(1 - \hat{p}) \geq 10$

(c) $n \geq 30$

(d) The data is a random sample from the population of interest.

(e) The sample is less than 10% of the population.

3. The report of a sample survey of 1,014 adults says, "With 95% confidence, between 9% and 15% of all Americans expect to spend more money on gifts this year than last year." What does the phrase "95% confidence" mean?

(a) 95% of all Americans will spend between 9% and 15% more than what they spent last year.

(b) 9% to 15% of all Americans will spend 95% of what they spent last year.

(c) there is a 95% chance that the percent who expect to spend more is between 9% and 15%.

(d) the method used to get the interval from 9% to 15%, when used over and over, produces intervals which include the true population percentage about 95% of the time.

(e) we can be 95% confident that the method used to get the interval always gives the right answer.

4. The survey in the previous question was conducted by calling land-line telephones, and those conducting the survey are concerned about the possibility of undercoverage, since some people do not own a phone or own only a cell phone. Which of the following is the best way for them to correct for this source of bias?

(a) Use a lower confidence level, such as 80%.

(b) Use a higher confidence level, such as 99%.

(c) Take a larger sample.

(d) Use a t -interval instead of a z -interval.

(e) Throw this sample out and start over again with a better sampling method.

5. Some scientists believe that a new drug would benefit about half of all people with a certain blood disorder. To estimate the proportion of patients who would benefit from taking the drug, the scientists will administer it to a random sample of patients who have the blood disorder. What sample size is needed so that the 95% confidence interval will have a margin of error of no more than 3%?

- (a) 748 (b) 1068 (c) 1503 (d) 2056 (e) 2401

6. Which of the following has the highest probability?

- (a) Randomly selecting a value greater than 3 from a standard Normal distribution.
(b) Randomly selecting a value greater than 3 from a t -distribution with 4 degrees of freedom.
(c) Randomly selecting a value greater than 3 from a t -distribution with 20 degrees of freedom.
(d) Randomly selecting a value less than 3 from a standard Normal distribution.
(e) Randomly selecting a value less than 3 from a t -distribution with 20 degrees of freedom.

7. A nationwide poll of 2,525 adults estimated with 95% confidence that the proportion of Americans who support health care reform is 0.78 ± 0.0162 . A member of Congress thinks that 95% confidence isn't enough. He wants to be 99% confident. How would the margin of error of a 99% confidence interval based on the same sample compare with the 95% interval?

- (a) It would be smaller, because it omits only 1% of the possible samples instead of 5%.
(b) It would be the same, because the sample is the same.
(c) It would be larger, because higher confidence requires a larger margin of error.
(d) Can't tell, because the margin of error varies from sample to sample.
(e) Can't tell, because it depends on the size of the population.

8.

You want to calculate a 98% confidence interval for a population mean from a sample of $n = 18$.

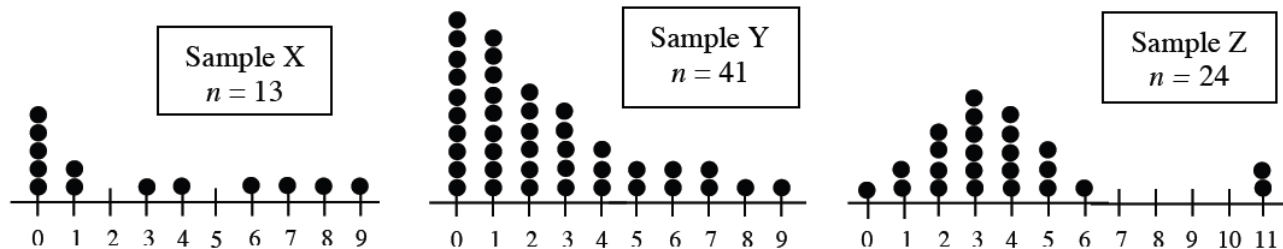
What is the appropriate critical t^* ?

- (a) 2.110 (b) 2.326 (c) 2.539 (d) 2.552 (e) 2.567

9. The heights (in inches) of males in the United States are believed to be approximately Normally distributed with mean μ . The mean height of a random sample of 25 American adult males is found to be $\bar{x} = 69.72$ inches and the standard deviation $s = 4.15$. What is the standard error of \bar{x} ?

- (a) 0.17 (b) 0.69 (c) 0.83 (d) 1.856 (e) 2.04

10. In checking conditions for constructing confidence intervals for a population mean, it's important to plot the distribution of sample data. Below are dot plots describing samples from three different populations. For which of the three samples would it be safe to construct a t -interval?



- (a) Sample X only
- (b) Sample Y only
- (c) Sample Z only
- (d) Samples Y and Z
- (c) None of the samples

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

1. A consumer watchdog organization estimates the mean weight of 1-ounce “Fun-Size” candy bars to see if customers are getting full value for their money. A random sample of 25 bars is selected and weighed, and the organization reports that a 90% confidence interval for the true mean weight of the candy bars is 0.992 to 0.998 ounces.

- (a) What is the point estimate from this sample?

- (b) What is the margin of error?

- (c) Interpret the 90% confidence *interval* 0.992 to 0.998 in the context of the problem.

- (d) Interpret the confidence level of 90% in the context of the problem.

2. A manufacturer of flashlights wants to know how well one of their newer styles is selling in a chain of large home-improvement stores. They select a simple random sample of 20 stores, record how many of the flashlights were sold in a 30-day period, and construct a 95% confidence interval for the mean number of flashlights sold.
 - (a) If, instead of constructing a 95% confidence interval, the flashlight manufacturer constructed a 98% confidence interval, would the 98% interval be wider, narrower, or the same width as the 95% interval? Explain.

 - (b) How would the width of confidence interval change if the flashlight manufacturer took a larger sample? Explain.

 - (c) The 20 stores in the sample were actually the only stores who provided sales figures from 36 stores that were randomly chosen to be in the sample. Can the manufacturer adjust the confidence interval to take this nonresponse into account? If so, how? If not, why not?

3. A simple random sample of 1100 males aged 12 to 17 in the United States were asked whether they played massive multiplayer online role-playing games (MMORPGs); 775 said that they did. We want to use this information to construct a 95% confidence interval to estimate the proportion of all U.S. males aged 12 to 17 who play MMORPGs.
 - (a) State the parameter our confidence interval will estimate.

 - (b) Identify the conditions that must be met to use this procedure, and explain how you know that each one has been satisfied.

 - (c) Find the appropriate critical value and the standard error of the sample proportion.

 - (d) Give the 95% confidence interval.

 - (e) Interpret the confidence interval constructed in part (d) in the context of the problem.

(f) Suppose you wanted to estimate the proportion of 12-to-17 year-old males who play MMORPG's with 95% confidence to within $\pm 2\%$. Calculate how large a sample you would need.

(g) If you wanted to have a margin of error of $\pm 2\%$ with 99% confidence, would your sample have to be larger, smaller, or the same size as the sample in part (f)? Explain.

(h) This poll was conducted through email. Explain how undercoverage could lead to a biased estimate in this case, and speculate about the direction of the bias.

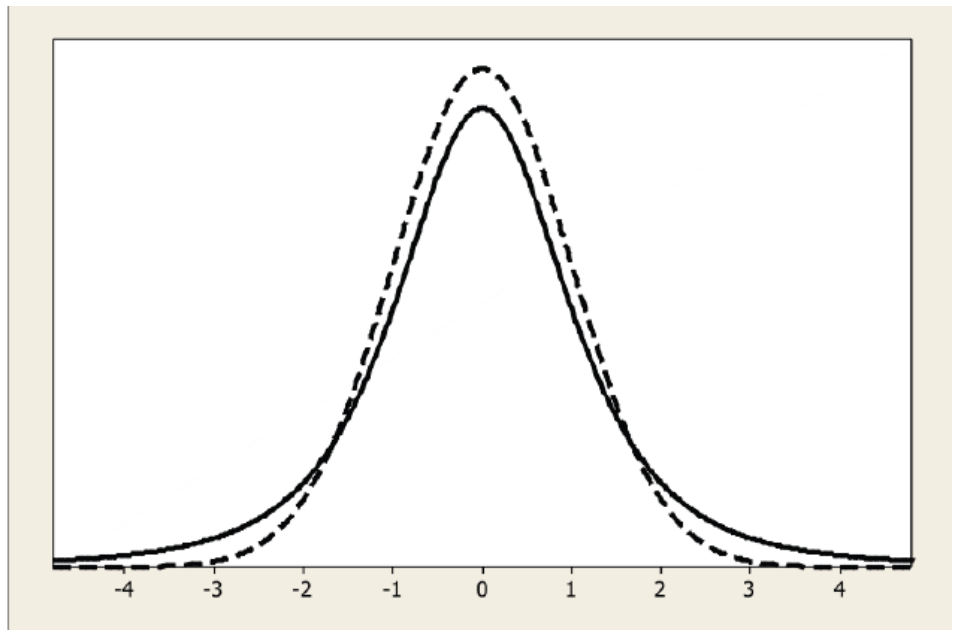
4. Below are the graphs of a standard Normal distribution and a t -distribution with 3 degrees of freedom.

(a) Indicated which graph is which and explain how you know.

Dotted graph =

Solid graph =

(b) On the same figure sketch a graph of a t -distribution with 1 degree of freedom.



5. Find the critical t^* value for each of the following confidence intervals:
- (a) 95% confidence interval with 8 degrees of freedom.
 - (b) 80% confidence interval when $n = 20$
6. You want to estimate the mean fuel efficiency of Ford Focus automobiles with 99% confidence and a margin of error of no more than 1 mile per gallon. Preliminary data suggests that $\sigma = 2.4$ miles per gallon is a reasonable estimate of the standard deviation for all cars of this make and model. How large a sample do you need?
7. Pauly's Pizza claims that the mean time it takes for them to deliver a pizza to dorms at Nat's college is 30 minutes. After a long wait one night, Nat decides to test this claim. He randomly selects 15 dormitory residents and asks them to record the time it takes for Pauly's to deliver the next time they order pizza. Here are the results (in minutes).

31	38	39	25	26
45	42	32	23	38
42	21	40	37	28

- (a) The sample mean is $\bar{x} = 33.8$ and the sample standard deviation is $s = 7.72$. Calculate and interpret the standard error of the mean for these data.
- (b) Construct and interpret a 90% confidence interval to estimate the mean delivery time. Does the data support Pauly's claim? Use the four-step process.