7.8: Chapter 7 Exercises

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1. Which confidence level would give the narrowest margin of error?

    a) 80%

    b) 90%

    c) 95%

    d) 99%

2. Suppose you compute a confidence interval with a sample size of 25. What will happen to the width of the confidence interval if the sample size increases to 50, assuming everything else stays the same? Choose the correct answer below.

    a) Gets smaller

    b) Stays the same

    c) Gets larger

3. For a confidence level of 90% with a sample size of 35, find the critical z values.

4. For a confidence level of 99% with a sample size of 18, find the critical z values.

5. A researcher would like to estimate the proportion of all children that have been diagnosed with autism spectrum disorder (ASD) in their county. They are using 95% confidence level and the Centers for Disease Control and Prevention (CDC) 2018 national estimate that 1 in 68 $\approx$ 0.0147 children are diagnosed with ASD. What sample size should the researcher use to get a margin of error to be within 2%?

6. A political candidate has asked you to conduct a poll to determine what percentage of people support her. If the candidate only wants a 9% margin of error at a 99% confidence level, what size of sample is needed?

7. A pilot study found that 72% of adult Americans would like an Internet connection in their car.

    a) Use the given preliminary estimate to determine the sample size required to estimate the proportion of adult Americans who would like an Internet connection in their car to within 0.02 with 95% confidence.

    b) Use the given preliminary estimate to determine the sample size required to estimate the proportion of adult Americans who would like an Internet connection in their car to within 0.02 with 99% confidence.

    c) If the information in the pilot study was not given, determine the sample size required to estimate the proportion of adult Americans who would like an Internet connection in their car to within 0.02 with 99% confidence.

8. Out of a sample of 200 adults ages 18 to 30, 54 still lived with their parents. Based on this, construct a 95% confidence interval for the true population proportion of adults ages 18 to 30 that still live with their parents.

9. In a random sample of 200 people, 135 said that they watched educational TV. Find and interpret the 95% confidence interval of the true proportion of people who watched educational TV.

10. In a certain state, a survey of 600 workers showed that 35% belonged to a union. Find and interpret the 95% confidence interval of true proportion of workers who belong to a union.

11. A teacher wanted to estimate the proportion of students who take notes in her class. She used data from a random sample size of 82 and found that 50 of them took notes. The 99% confidence interval for the proportion of student that take notes is _____ < p < _____.

12. A random sample of 150 people was selected and 12% of them were left-handed. Find and interpret the 90% confidence interval for the proportion of left-handed people.

13. A survey asked people if they were aware that maintaining a healthy weight could reduce the risk of stroke. A 95% confidence interval was found using the survey results to be (0.54, 0.62). Which of the following is the correct interpretation of this interval?

a) We are 95% confident that the interval $0.54 < p < 0.62$ contains the population proportion of people who are aware that maintaining a healthy weight could reduce the risk of stroke.

b) There is a 95% chance that the sample proportion of people who are aware that maintaining a healthy weight could reduce the risk of stroke is between $0.54 < p < 0.62$.

c) There is a 95% chance of having a stroke if you do not maintain a healthy weight.

d) There is a 95% chance that the proportion of people who will have a stroke is between 54% and 62%.

14. Gallup tracks daily the percentage of Americans who approve or disapprove of the job Donald Trump is doing as president. Daily results are based on telephone interviews with approximately 1,500 national adults. Margin of error is ±3 percentage points. On December 15, 2017, the gallop poll using a 95% confidence level showed that 34% approved of the job Donald Trump was doing. Which of the following is the correct statistical interpretation of the confidence interval?

a) As of December 15, 2017, 34% of American adults approve of the job Donald Trump is doing as president.

b) We are 95% confident that the interval $0.31 < p < 0.37$ contains the proportion of American adults who approve of the job Donald Trump is doing as president as of December 15, 2017.

c) As of December 15, 2017, 95% of American adults approve of the job Donald Trump is doing as president. d) We are 95% confident that the proportion of adult Americans who approve of the job Donald Trump is doing as president is 0.34 as of December 15, 2017.

15. A laboratory in Florida is interested in finding the mean chloride level for a healthy resident in the state. A random sample of 25 healthy residents has a mean chloride level of 80 mEq/L. If it is known that the chloride levels in healthy individuals residing in Florida is normally distributed with a population standard deviation of 27 mEq/L, find and interpret the 95% confidence interval for the true mean chloride level of all healthy Florida residents.

16. Out of 500 people sampled in early October 2020, 315 preferred Biden. Based on this, compute the 95% confidence interval for the proportion of the voting population that preferred Biden.

17. The age when smokers first start from previous studies is normally distributed with a mean of 13 years old with a population standard deviation of 2.1 years old. A survey of smokers of this generation was done to estimate if the mean age has changed. The sample of 33 smokers found that their mean starting age was 13.7 years old. Find the 99% confidence interval of the mean.

18. The scores on an examination in biology are approximately normally distributed with a known standard deviation of 20 points. The following is a random sample of scores from this year's examination: 403, 418, 460, 482, 511, 543, 576, 421. Find and interpret the 99% confidence interval for the population mean scores.

19. The undergraduate grade point average (GPA) for students admitted to the top graduate business schools was 3.53. Assume this estimate was based on a sample of 8 students admitted to the top schools. Assume that the population is normally distributed with a standard deviation of 0.18. Find and interpret the 99% confidence interval estimate of the mean undergraduate GPA for all students admitted to the top graduate business schools.

20. The Food & Drug Administration (FDA) regulates that fresh albacore tuna fish that is consumed is allowed to contain 0.82 ppm of mercury or less. A laboratory is estimating the amount of mercury in tuna fish for a new company and needs to have a margin of error within 0.03 ppm of mercury with 95% confidence. Assume the population standard deviation is 0.138 ppm of mercury. What sample size is needed?

21. You want to obtain a sample to estimate a population mean age of the incoming fall term transfer students. Based on previous evidence, you believe the population standard deviation is approximately 5.3. You would like to be 90% confident that your estimate is within 1.9 of the true population mean. How large of a sample size is required?

22. SAT scores are distributed with a mean of 1,500 and a standard deviation of 300. You are interested in estimating the average SAT score of first year students at your college. If you would like to limit the margin of error of your 95% confidence interval to 25 points, how many students should you sample?

23. An engineer wishes to determine the width of a particular electronic component. If she knows that the standard deviation is 1.2 mm, how many of these components should she consider to be 99% sure of knowing the mean will be within 0.5 mm?

24. For a confidence level of 90% with a sample size of 30, find the critical t values.

25. For a confidence level of 99% with a sample size of 24, find the critical t values.

26. For a confidence level of 95% with a sample size of 40, find the critical t values.

27. The amount of money in the money market accounts of 26 customers is found to be approximately normally distributed with a mean of $18,240 and a sample standard deviation of $1,100. Find and interpret the 95% confidence interval for the mean amount of money in the money market accounts at this bank.

28. A professor wants to estimate how long students stay connected during two-hour online lectures. From a random sample of 25 students, the mean stay time was 93 minutes with a standard deviation of 10 minutes. Assuming the population has a normal distribution, compute a 95% confidence interval estimate for the population mean.

29. A random sample of stock prices per share (in dollars) is shown. Find and interpret the 90% confidence interval for the mean stock price. Assume the population of stock prices is normally distributed.

26.60 75.37 3.81 28.37 40.25 13.88 53.80 28.25 10.87 12.25

30. In a certain city, a random sample of executives have the following monthly personal incomes (in thousands) 35, 43, 29, 55, 63, 72, 28, 33, 36, 41, 42, 57, 38, 30. Assume the population of incomes is normally distributed. Find and interpret the 95% confidence interval for the mean income.

31. A tire manufacturer wants to estimate the average number of miles that may be driven in a tire of a certain type before the tire wears out. Assume the population is normally distributed. A random sample of tires is chosen and are driven until they wear out and the number of thousands of miles is recorded, find and interpret the 99% confidence interval for the mean using the sample data 32, 33, 28, 37, 29, 30, 22, 35, 23, 28, 30, 36.

32. Recorded here are the germination times (in days) for ten randomly chosen seeds of a new type of bean: 18, 12, 20, 17, 14, 15, 13, 11, 21, 17. Assume that the population germination time is normally distributed. Find and interpret the 99% confidence interval for the mean germination time.

33. A sample of the length in inches for newborns is given below. Assume that lengths are normally distributed. Find the 95% confidence interval of the mean length.

Length	20.8	16.9	21.9	18	15	20.8	15.2	22.4	19.4	20.5

34. Suppose you are a researcher in a hospital. You are experimenting with a new tranquilizer. You collect data from a random sample of 10 patients. The period of effectiveness of the tranquilizer for each patient (in hours) is as follows:

Hours	2	2.9	2.6	2.9	3	3	2	2.1	2.9	2.1

a) What is a point estimate for the population mean length of time?

b) What must be true in order to construct a confidence interval for the population mean length of time in this situation? Choose the correct answer below.

i. The sample size must be greater than 30.

ii. The population must be normally distributed.

iii. The population standard deviation must be known.

iv. The population mean must be known.

c) Construct a 99% confidence interval for the population mean length of time.

d) What does it mean to be "99% confident" in this problem? Choose the correct answer below.

i. 99% of all confidence intervals found using this same sampling technique will contain the population mean time.

ii. There is a 99% chance that the confidence interval contains the sample mean time.

iii. The confidence interval contains 99% of all sample times.

iv. 99% of all times will fall within this interval.

e) Suppose that the company releases a statement that the mean time for all patients is 2 hours. Is this possible? Is it likely?

35. Which of the following would result in the widest confidence interval?

a) A sample size of 100 with 99% confidence.

b) A sample size of 100 with 95% confidence.

c) A sample size of 30 with 95% confidence.

d) A sample size of 30 with 99% confidence.

36. The world's smallest mammal is the bumblebee bat (also known as Kitti's hog-nosed bat or Craseonycteris thonglongyai). Such bats are roughly the size of a large bumblebee. A sample of bats, weighed in grams, is given in the below. Assume that bat weights are normally distributed. Find the 99% confidence interval of the mean.

Weight	
2.11	1.53
2.27	1.98
2.27	2.11
1.75	2.06
1.92	2.01

37. The total of individual weights of garbage discarded by 20 households in one week is normally distributed with a mean of 30.2 lbs. with a sample standard deviation of 8.9 lbs. Find the 90% confidence interval of the mean.

38. A student was asked to find a 90% confidence interval for widget width using data from a random sample of size $n = 29$. Which of the following is a correct interpretation of the interval $14.3 < \mu < 26.8$? Assume the population is normally distributed.

a) There is a 90% chance that the sample mean widget width will be between 14.3 and 26.8.

b) There is a 90% chance that the widget width is between 14.3 and 26.8.

c) With 90% confidence, the width of a widget will be between 14.3 and 26.8.

d) With 90% confidence, the mean width of all widgets is between 14.3 and 26.8.

e) The sample mean width of all widgets is between 14.3 and 26.8, 90% of the time.

39. A researcher finds a 95% confidence interval for the average commute time in minutes using public transit is (15.75, 28.25). Which of the following is the correct interpretation of this interval?

a) We are 95% confident that all commute time in minutes for the population using public transit is between 15.75 and 28.25 minutes.

b) There is a 95% chance commute time in minutes using public transit is between 15.75 and 28.25 minutes.

c) We are 95% confident that the interval $15.75 < \mu < 28.25$ contains the sample mean commute time in minutes using public transportation.

d) We are 95% confident that the interval $15.75 < \mu < 28.25$ contains the population mean commute time in minutes using public transportation