Chapter 7 - Confidence Intervals and Sample Size

1. The term \( \frac{z_{\alpha/2}}{\sqrt{n}} \) describes the _________________.
   A) unbiased estimator       C) maximum error of estimate
   B) confidence interval       D) interval estimate
   Ans: C  Difficulty: Easy  Section: 7.1

2. An interval estimate may or may not contain the true value of the parameter being estimated.
   Ans: True  Difficulty: Easy  Section: 7.1

3. The confidence level of an interval estimate of a parameter is the probability that the interval estimate will contain the parameter.
   Ans: True  Difficulty: Easy  Section: 7.1

4. When computing a confidence interval for a population mean using raw data, round off to two more decimal places than the number of decimal places in the original data.
   Ans: False  Difficulty: Easy  Section: 7.1

5. The ________________ is the maximum likely difference between the point estimate of a parameter and the actual value of the parameter.
   Ans: maximum error of estimate
   Difficulty: Easy  Section: 7.1

6. The formula for the confidence interval of the mean for a specific \( \alpha \) is
   \[ X - z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < \mu < X + z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \]
   Ans: \( X - z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < \mu < X + z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \)
   Difficulty: Moderate  Section: 7.1

7. What is the value of \( \alpha \) used in describing the confidence interval shown below.

   A) 0.01  B) 0.02  C) 0.04  D) 0.05
   Ans: B  Difficulty: Easy  Section: 7.1
8. Identify the degree of confidence displayed in the confidence interval shown below.

\[ \frac{\alpha}{2} = 0.05 \]

A) 90%  B) 95%  C) 98%  D) 99%

Ans: A  Difficulty: Easy  Section: 7.1

9. The value of \( \frac{\alpha}{2} \) used in the figure below is 0.02.

\[ \frac{\alpha}{2} = 0.05 \]

Ans: False  Difficulty: Easy  Section: 7.1

10. What value of \( z_{\alpha/2} \) is used in confidence interval shown below?

\[ \frac{\alpha}{2} = 0.05 \]

Ans: 1.65  Difficulty: Easy  Section: 7.1

11. A sample of 35 different payroll departments found that employees worked an average of 240.6 days a year. If the population standard deviation is 18.8 days, find the 90% confidence interval for the average number of days \( \mu \) worked by all employees who are paid through payroll departments.

A) 232.4 < \( \mu \) < 248.8  
B) 230.9 < \( \mu \) < 250.3

C) 235.4 < \( \mu \) < 245.8  
D) 236.8 < \( \mu \) < 244.4

Ans: C  Difficulty: Moderate  Section: 7.1
12. A study of 75 bolts of carpet showed that their average length was 76.2 yards. The standard deviation of the population is 4.6 yards. Which of the following is the 98% confidence interval for the mean length per bolt of carpet?

A) \( 75.2 < \mu < 77.2 \)  
B) \( 73.7 < \mu < 78.7 \)  
C) \( 75.6 < \mu < 76.8 \)  
D) \( 75.0 < \mu < 77.4 \)

Ans: D  Difficulty: Moderate  Section: 7.1

13. A student looked up the number of years served by 35 of the more than 100 Supreme Court justices. The average number of years served by those 35 justices was 13.8. If the standard deviation of the entire population is 7.3 years, find the 95% confidence interval for the average number of years served by all Supreme Court justices?

A) \( 11.4 < \mu < 16.2 \)  
B) \( 11.8 < \mu < 15.8 \)  
C) \( 12.2 < \mu < 15.4 \)  
D) \( 12.6 < \mu < 15.0 \)

Ans: A  Difficulty: Moderate  Section: 7.1

14. An economics professor randomly selected 100 millionaires in the United States. The average age of these millionaires was 54.8 years. If the standard deviation of the entire population of millionaires is 7.9 years, find the 95% confidence interval for the mean age of all United States millionaires?

A) \( 54.0 < \mu < 55.6 \)  
B) \( 53.5 < \mu < 56.1 \)  
C) \( 53.3 < \mu < 56.3 \)  
D) \( 52.8 < \mu < 56.8 \)

Ans: C  Difficulty: Moderate  Section: 7.1

15. According to a study of 90 truckers, a trucker drives, on average, 540 miles per day. If the standard deviation of the miles driven per day for the population of truckers is 40, find the 99% confidence interval of the mean number of miles driven per day by all truckers?

Ans: \( 529 < \mu < 551 \)  
Difficulty: Moderate  Section: 7.1

16. The average score for 36 teenage boys playing a certain computer game was 90,000 points per player. If the standard deviation of the population is 20,000 points, find the 95% confidence interval of the mean score for all teenage boys?

Ans: \( 83,000 < \mu < 97,000 \)  
Difficulty: Moderate  Section: 7.1

17. The average number of mosquitos caught in 49 mosquito traps in a particular environment was 600 per trap. If the standard deviation of mosquitos caught in the entire population of traps is 50 mosquitos. What is the 99% confidence interval for the true mean number of mosquitos caught in all mosquito traps?

Ans: \( 582 < \mu < 618 \)  
Difficulty: Moderate  Section: 7.1
18. A study of 95 apple trees showed that the average number of apples per tree was 825. The standard deviation of the population is 150. Which of the following is the 95% confidence interval for the mean number of apples per tree for all trees?  
A) $810 < \mu < 840$  B) $800 < \mu < 850$  C) $795 < \mu < 855$  D) $790 < \mu < 860$  
Ans: C  Difficulty: Moderate  Section: 7.1

19. A study of 45 professors showed that the average time they spent creating test questions was 15.5 minutes per question. The standard deviation of the population is 4.8. Which of the following is the 90% confidence interval for the average number of minutes it takes to create a test question?  
A) $14.6 < \mu < 16.4$  C) $14.3 < \mu < 16.7$  
B) $13.1 < \mu < 17.9$  D) $14.9 < \mu < 16.1$  
Ans: C  Difficulty: Moderate  Section: 7.1

20. Jennifer wants to find a 95% confidence interval for the time it takes her to get to work. She kept records for 30 days and found her average time to commute to work was 20.5 minutes with a standard deviation for the population of 3.9 minutes. Jennifer's maximum error of estimate would be 1.4 minutes.  
Ans: True  Difficulty: Moderate  Section: 7.1

21. A study of 50 white mice showed that their average weight was 6.2 ounces. The standard deviation of the population is 0.9 ounces. Which of the following is the 98% confidence interval for the mean weight per white mouse?  
A) $5.90 < \mu < 6.50$  C) $6.05 < \mu < 6.35$  
B) $5.95 < \mu < 6.45$  D) $5.61 < \mu < 6.79$  
Ans: A  Difficulty: Moderate  Section: 7.1

22. If a population has a standard deviation of 12, what is the minimum number of samples that need to be averaged in order to be 95% confident that the average of the means is within 2 of the true mean?  
A) 273  B) 12  C) 139  D) 24  
Ans: C  Difficulty: Moderate  Section: 7.1

23. A study of nickels showed that the the standard deviation of the weight of nickels is 300 milligrams. A coin counter manufacturer wishes to find the 98% confidence interval for the average weight of a nickel. How many nickels does he need to weigh to obtain an average accurate to within 25 milligrams?  
A) 144  B) 782  C) 959  D) 554  
Ans: B  Difficulty: Difficult  Section: 7.1
24. A researcher conducted a study of the access speed of 50 hard drives and concluded that his maximum error of estimate was 24. If he were to conduct a second study to reduce the maximum error of estimate to 6, about how many hard drives should he include in his new sample?
   A) 50   B) 100   C) 200   D) 800
   Ans: D   Difficulty: Difficult   Section: 7.1

25. A previous analysis of paper boxes showed that the standard deviation of their lengths is 15 millimeters. A packer wishes to find the 95% confidence interval for the average length of a box. How many boxes does he need to measure to be accurate within 3 millimeters?
   A) 25   B) 136   C) 97   D) 69
   Ans: C   Difficulty: Difficult   Section: 7.1

26. A study of peach trees found that the average number of peaches per tree was 625. The standard deviation of the population is 70 peaches per tree. A scientist wishes to find the 99% confidence interval for the mean number of peaches per tree. How many trees does she need to sample to obtain an average accurate to within 14 peaches per tree?
   A) 25   B) 136   C) 151   D) 167
   Ans: D   Difficulty: Difficult   Section: 7.1

27. A study of elephants is conducted to determine the average weight of a certain subspecies of elephants. The standard deviation for the population is 500 pounds. At a 95% level, how many elephants need to be weighed so the average weight will be accurate to within 200 pounds?
   A) 25   B) 29   C) 34   D) 57
   Ans: A   Difficulty: Difficult   Section: 7.1

28. The t-distribution must be used when the sample size is greater than 30 and the variable is normally or approximately normally distributed.
   Ans: False   Difficulty: Easy   Section: 7.2

29. The t-distribution has a variance that is greater than one.
   Ans: True   Difficulty: Moderate   Section: 7.2

30. One of the characteristics of the t-distribution is that the curve never touches the ____-axis.
   Ans: x
   Difficulty: Easy   Section: 7.2

31. The ______________ are the number of values that are free to vary after a sample statistic has been computed.
   Ans: degrees of freedom
   Difficulty: Easy   Section: 7.2
32. In a study using 16 samples, and in which the population variance is unknown, the distribution that should be used to calculate confidence intervals is
A) a standard normal distribution.
B) a t distribution with 15 degrees of freedom.
C) a t distribution with 16 degrees of freedom.
D) a t distribution with 17 degrees of freedom.
Ans: B     Difficulty: Easy     Section: 7.2

33. A food snack manufacturer samples 13 bags of pretzels off the assembly line and weighs their contents. If the sample mean is 13.7 oz. and the sample standard deviation is 0.50 oz., find the 95% confidence interval of the true mean.
A) 13.6 < μ < 13.8
B) 12.6 < μ < 14.8
C) 11.5 < μ < 15.9
D) 13.4 < μ < 14.0
Ans: D     Difficulty: Moderate     Section: 7.2

34. 4 squirrels were found to have an average weight of 9.0 ounces with a sample standard deviation is 0.7. Find the 95% confidence interval of the true mean.
A) 7.9 < μ < 10.1
B) 6.8 < μ < 11.2
C) 8.3 < μ < 9.7
D) 8.7 < μ < 9.4
Ans: A     Difficulty: Moderate     Section: 7.2

35. The winning team's score in 5 high school basketball games was recorded. If the sample mean is 72.3 points and the sample standard deviation is 11.0 points, find the 98% confidence interval of the true mean.
A) 67.4 < μ < 77.2
B) 53.9 < μ < 90.7
C) 60.8 < μ < 83.8
D) 35.4 < μ < 109.2
Ans: B     Difficulty: Moderate     Section: 7.2

36. The rounding rule for a confidence interval for a proportion is to round off to three decimal places.
Ans: True     Difficulty: Easy     Section: 7.3

37. The symbol for the sample proportion is ______.
Ans: \( \hat{p} \)
Difficulty: Easy     Section: 7.3

38. If \( \hat{p} \) is equal to 0.86, then \( \hat{q} \) is equal to ______.
A) 0.86    B) 0.50    C) 0.41    D) 0.14
Ans: D     Difficulty: Easy     Section: 7.3

39. In a study of 100 new cars, 31 are white. Find \( \hat{p} \) and \( \hat{q} \), where \( \hat{p} \) is the proportion of new cars that are white.
A) \( \hat{p} = 0.31, \hat{q} = 0.31 \)
B) \( \hat{p} = 0.31, \hat{q} = 0.69 \)
C) \( \hat{p} = 0.69, \hat{q} = 0.31 \)
D) \( \hat{p} = 0.69, \hat{q} = 0.69 \)
Ans: B     Difficulty: Easy     Section: 7.3
40. A sample of 400 racing cars showed that 80 of them cost over $700,000. What is the 99% confidence interval for the true proportion of racing cars that cost over $700,000?
Ans: 0.148 < p < 0.252
Difficulty: Moderate Section: 7.3

41. A recent study of 750 internet users in Europe found that 35% of internet users were women. What is the 95% confidence interval of the true proportion of women in Europe who use the internet?
A) 0.349 < p < 0.351 C) 0.316 < p < 0.384
B) 0.321 < p < 0.379 D) 0.309 < p < 0.391
Ans: C Difficulty: Moderate Section: 7.3

42. A survey of 800 women shoppers found that 17% of them shop on impulse. What is the 98% confidence interval for the true proportion of women shoppers who shop on impulse?
A) 0.167 < p < 0.173 C) 0.139 < p < 0.201
B) 0.144 < p < 0.196 D) 0.136 < p < 0.204
Ans: C Difficulty: Moderate Section: 7.3

43. A random sample of 60 voters found that 42% were going to vote for a certain candidate. Find the 99% limit for the population proportion of voters who will vote for that candidate.
A) 25.6% < p < 58.4% C) 29.5% < p < 54.5%
B) 27.5% < p < 56.5% D) 33.8% < p < 50.2%
Ans: A Difficulty: Moderate Section: 7.3

44. A random sample of 65 printers discovered that 20 of them were being used in small businesses. Find the 95% limit for the population proportion of printers that are used in small businesses.
A) 0.101 < p < 0.514 C) 0.213 < p < 0.402
B) 0.195 < p < 0.420 D) 0.270 < p < 0.345
Ans: B Difficulty: Moderate Section: 7.3

45. In a sample of 55 mice, a biologist found that 44% were able to run a maze in 30 seconds or less. Find the 90% limit for the population proportion of mice who can run a maze in 30 seconds or less.
A) 38.5% < p < 49.5% C) 33.0% < p < 55.0%
B) 35.4% < p < 52.6% D) 27.4% < p < 60.6%
Ans: C Difficulty: Moderate Section: 7.3
46. It was found that in a sample of 90 teenage boys, 70% of them have received speeding tickets. What is the 90% confidence interval of the true proportion of teenage boys who have received speeding tickets?

A) $0.620 < p < 0.780$
B) $0.591 < p < 0.812$
C) $0.584 < p < 0.830$
D) $0.615 < p < 0.805$

Ans: A Difficulty: Moderate Section: 7.3

47. The Pizza Shop wanted to determine what proportion of its customers ordered only cheese pizza. Out of 80 customers surveyed, 15 ordered only cheese pizza. What is the 99% confidence interval of the true proportion of customers who order only cheese pizza?

A) $0.075 < p < 0.300$
B) $0.086 < p < 0.289$
C) $0.102 < p < 0.273$
D) $0.115 < p < 0.260$

Ans: A Difficulty: Moderate Section: 7.3

48. In a sample of 855 bartenders, 48.0% report hearing complaints from patrons about their jobs. If the maximum error of estimate for the proportion of bartenders hearing job complaints is 4.4 percentage points, what is the degree of confidence used?

A) 90%  B) 95%  C) 98%  D) 99%

Ans: D Difficulty: Difficult Section: 7.3

49. A recent poll of 700 people who work indoors found that 278 smoke. If the researchers want to be 98% confident of their results to within 3.5 percentage points, how large a sample is necessary?

A) 751  B) 1062  C) 33  D) 532

Ans: B Difficulty: Difficult Section: 7.3

50. A report states that 40% of home owners have a vegetable garden. How large a sample is needed to estimate the true proportion of home owners who have vegetable gardens to within 6 percentage points with 96% confidence?

A) 83  B) 141  C) 205  D) 281

Ans: D Difficulty: Moderate Section: 7.3

51. The Academy of Orthopedic Surgeons states that 80% of women wear shoes that are too small for their feet. A researcher wants to be 98% confident that this proportion is within 3 percentage points of the true proportion. How large a sample is necessary?

A) 966  B) 683  C) 1183  D) 484

Ans: A Difficulty: Difficult Section: 7.3

52. John Davis, a manager of a supermarket, wants to estimate the proportion of customers who use food stamps at his store. He has no initial estimate of what the sample proportion will be. How large a sample is required to estimate the true proportion to within 3 percentage points with 98% confidence?

A) 756  B) 1,849  C) 1,067  D) 1,509

Ans: D Difficulty: Moderate Section: 7.3
53. A retailer wants to estimate with 99% confidence the number of people who shop at his store. A previous study showed that 24% of those interviewed had shopped at his store. He wishes to be accurate within 3% of the true proportion. The minimum sample size necessary would be 1,100.
Ans: False Difficulty: Moderate Section: 7.3

54. A quality control expert wants to estimate the proportion of defective components that are being manufactured by his company. A sample of 300 components showed that 20 were defective. How large a sample is needed to estimate the true proportion of defective components to within 2.5 percentage points with 99% confidence?
Ans: 661 Difficulty: Moderate Section: 7.3

55. A report states that 44% of home owners had a vegetable garden. How large a sample is needed to estimate the true proportion of home owners who have vegetable gardens to within 6% with 90% confidence?
A) 47 B) 94 C) 187 D) 374
Ans: C Difficulty: Moderate Section: 7.3

56. A college believes that 24% of applicants to that school have parents who have remarried. How large a sample is needed to estimate the true proportion of students who have parents who have remarried to within 3 percentage points with 99% confidence?
A) 450 B) 1101 C) 1350 D) 2025
Ans: C Difficulty: Moderate Section: 7.3

57. A chi-square distribution is negatively skewed.
Ans: False Difficulty: Easy Section: 7.4

58. A chi-square variable cannot be negative, and the distributions are positively skewed.
Ans: True Difficulty: Easy Section: 7.4

59. The area under each chi-square distribution is equal to ________.
Ans: 1.00 Difficulty: Easy Section: 7.4

60. In order to find confidence intervals for variances and standard deviations, one must assume that the variable is ________________.
Ans: normally distributed Difficulty: Easy Section: 7.4

61. The formula for the confidence interval for a standard deviation is
\[
\sqrt{\frac{(n-1)s^2}{\chi_{right}^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_{left}^2}}
\]
Ans: Difficulty: Easy Section: 7.4
62. What is the value for $\chi^2_{left}$ for a 95% confidence interval when $n = 18$?
   A) 7.564  B) 8.672  C) 9.390  D) 8.231
   Ans: A  Difficulty: Moderate  Section: 7.4

63. What is the value for $\chi^2_{right}$ for a 98% confidence interval when $n = 12$?
   A) 27.688  B) 24.725  C) 21.920  D) 26.217
   Ans: B  Difficulty: Moderate  Section: 7.4

64. The value for $\chi^2_{right}$ for a 95% confidence interval when $n = 15$ is 26.119.
   Ans: True  Difficulty: Easy  Section: 7.4

65. Find the values for $\chi^2_{left}$ and $\chi^2_{right}$ when $\alpha = .05$ and $n = 17$.
   A) 6.908 and 28.845  C) 7.962 and 26.296
   B) 7.564 and 30.191  D) 8.672 and 27.587
   Ans: A  Difficulty: Moderate  Section: 7.4

66. The value for $\chi^2_{left}$ for a 99% confidence interval when $n = 24$ is 9.262.
   Ans: True  Difficulty: Easy  Section: 7.4

67. What is the 90% confidence interval for the variance of exam scores for 28 algebra students, if the standard deviation of their last exam was 12.7?
   A) $\sigma^2 < 118.3$  C) $108.6 < \sigma^2 < 269.6$
   B) $122.8 < \sigma^2 < 316.5$  D) $10.4 < \sigma^2 < 16.4$
   Ans: C  Difficulty: Moderate  Section: 7.4

68. What is the 95% confidence interval for the standard deviation of birth weights at County General Hospital, if the standard deviation of the last 25 babies born there was 1.1 pounds?
   A) 0.8 < $\sigma$ < 2.1  B) 0.7 < $\sigma$ < 2.3  C) 0.8 < $\sigma$ < 1.9  D) 0.9 < $\sigma$ < 1.5
   Ans: D  Difficulty: Moderate  Section: 7.4

69. For a random sample of 23 European countries, the variance on life expectancy was 7.3 years. What is the 95% confidence interval for the variance of life expectancy in all of Europe?
   A) $27.2 < \sigma^2 < 118.3$  C) $4.4 < \sigma^2 < 14.6$
   B) $5.6 < \sigma^2 < 10.3$  D) $28.9 < \sigma^2 < 115.0$
   Ans: C  Difficulty: Moderate  Section: 7.4
70. Find the 95% confidence interval for the variance of the heights of maple trees if a sample of 16 trees has a standard deviation of 8.2 feet.
   A) \(6.2 < \sigma^2 < 10.2\)  
   B) \(6.1 < \sigma^2 < 12.7\)  
   C) \(51.2 < \sigma^2 < 83.2\)  
   D) \(36.7 < \sigma^2 < 161.1\)  
   Ans: D  Difficulty: Moderate  Section: 7.4

71. Find the 95% confidence interval for the standard deviation of the lengths of pipes if a sample of 16 pipes has a standard deviation of 10.6 inches.
   A) \(8.6 < \sigma < 12.6\)  
   B) \(7.8 < \sigma < 16.4\)  
   C) \(96.4 < \sigma < 128.4\)  
   D) \(61.3 < \sigma < 269.1\)  
   Ans: B  Difficulty: Difficult  Section: 7.4