

tables and chairs, he wishes to — per customer.  
 The checks for 9 randomly sampled customers had an average of \$18.30 and a standard deviation of \$3.60. Construct a 95 percent confidence interval for the size of the average check per customer.

■ 7-88 John Deer, a horticulturist at Northern Carrboro State University, knows that a certain strain of corn will always produce between 80 and 140 bushels per acre. For a confidence level of 90 percent, how many 1-acre samples must be taken in order to estimate the average production per acre to within  $\pm 5$  bushels per acre?

## Chapter Concepts Test

Circle the correct answer or fill in the blank. *Answers are in the back of the book.*

- ☐ ☐ 1. A statistic is said to be an efficient estimator of a population parameter if, with increasing sample size, it becomes almost certain that the value of the statistic comes very close to that of the population parameter.
- ☐ ☐ 2. An interval estimate is a range of values used to estimate the shape of a population's distribution.
- ☐ ☐ 3. If a statistic tends to assume values higher than the population parameter as frequently as it tends to assume values that are lower, we say that the statistic is an unbiased estimate of the parameter.
- ☐ ☐ 4. The probability that a population parameter will lie within a given interval estimate is known as the confidence level.
- ☐ ☐ 5. With increasing sample size, the  $t$  distribution tends to become flatter in shape.
- ☐ ☐ 6. We must always use the  $t$  distribution, rather than the normal, whenever the standard deviation of the population is not known.
- ☐ ☐ 7. We may obtain a crude estimate of the standard deviation of some population if we have some information about its range.
- ☐ ☐ 8. When using the  $t$  distribution in estimation, we must assume that the population is approximately normal.
- ☐ ☐ 9. Using high confidence levels is not always desirable because high confidence levels produce large confidence intervals.
- ☐ ☐ 10. There is a different  $t$  distribution for each possible sample size.
- ☐ ☐ 11. A point estimate is often insufficient because it is either right or wrong.
- ☐ ☐ 12. A sample mean is said to be an unbiased estimator of a population mean because no other estimator could extract from the sample additional information about the population mean.

13. The most frequently used estimator of  $\sigma$  is  $s$ .
14. The standard error of the proportion is calculated as  $\sqrt{p(1 - p)/n}$ .
15. The degrees of freedom used in a  $t$ -distribution estimation are equal to the sample size.
16. The  $t$  distribution is less able to be approximated by a normal distribution as the sample size increases.
17. The  $t$  distribution need not be used in estimating if you know the standard deviation of the population.
18. The sample median is always the best estimator of the population median.
19. As the width of a confidence interval increases, the confidence level associated with the interval also increases.
20. Estimating the standard error of the mean of a finite population using an estimate of the population standard deviation requires the use of the  $t$  distribution for calculating subsequent confidence intervals.
21. The percentages in the  $t$  distribution table correspond to the chance that the true population parameter will fall outside our confidence interval.
22. In a normal distribution, 100 percent of the population lies within  $\pm 3$  standard deviations of the mean.
23. When choosing an estimator of a population parameter, one should consider:
  - (a) Sufficiency.
  - (b) Clarity.
  - (c) Efficiency.
  - (d) All of these.
  - (e) (a) and (c) but not (b).
24. Suppose that 200 members of a group were asked whether they like a particular product. Fifty said yes; 150 said no. Assuming "yes" means a success, which of the following is correct?
  - (a)  $\bar{p} = 0.33$ .
  - (b)  $\bar{p} = 0.25$ .
  - (c)  $p = 0.33$ .
  - (d)  $p = 0.25$ .
  - (e) (b) and (d) only.
25. Assume that you take a sample and calculate  $\bar{x}$  as 100. You then calculate the upper limit of a 90 percent confidence interval for  $\mu$ ; its value is 112. What is the lower limit of this confidence interval?
  - (a) 88.
  - (b) 92.
  - (c) 100.
  - (d) It cannot be determined from the information given.
26. After taking a sample and computing  $\bar{x}$ , a statistician says, "I am 88 percent confident that the population mean is between 106 and 122." What does she really mean?
  - (a) The probability is 0.88 that  $\mu$  is between 106 and 122.
  - (b) The probability is 0.88 that  $\mu = 114$ , the midpoint of the interval.
  - (c) Eighty-eight percent of the intervals calculated from samples of this size will contain the population mean.
  - (d) All of these.
  - (e) (a) and (c) but not (b).

- A B C D E** 27. Which of the following is a necessary condition for using a  $t$  distribution table?
- $n$  is small.
  - $s$  is known but  $\sigma$  is not.
  - The population is infinite.
  - All of these.
  - (a) and (b) but not (c).
- A B C D** 28. Which of the following  $t$  distributions would be expected to have the most area in its tails?
- $\bar{x} = 0.83$ , degrees of freedom = 12.
  - $\bar{x} = 15$ , degrees of freedom = 19.
  - $\bar{x} = 15$ ,  $n = 19$ .
  - $\bar{x} = 8.3$ ,  $n = 12$ .
- A B C D E** 29. Which of the following is a difference between  $z$  tables and  $t$  tables?
- The  $t$  table has values for only a few percentages.
  - The  $t$  table measures the chance that the population parameter we are estimating will be in our confidence interval.
  - We must specify the degrees of freedom with which we are dealing when using a  $z$  table.
  - All of these.
  - (a) and (b) but not (c).
- A B C D** 30. Suppose we are attempting to estimate a population variance by using  $s^2$ . It is incorrect to calculate  $s^2$  as  $\sum(x - \bar{x})^2/n$  because the value would be:
- Biased.
  - Inefficient.
  - Inconsistent.
  - Insufficient.
- A B C D E** 31. When considering samples with size greater than 30, we use the normal table even if the population standard deviation is unknown. Why is this?
- The calculation of the degrees of freedom becomes difficult for large sample sizes.
  - The number of percentages we need for the calculation of confidence intervals exceeds the number contained in the  $t$  tables.
  - It is difficult to calculate  $\bar{x}$  (and hence  $s^2$ ) for large samples.
  - None of these.
  - (a) and (c) but not (b).
- A B C D E** 32. Assume that, from a population with  $N = 50$ , a sample of size 15 is drawn;  $\sigma^2$  is known to be 36, and  $s^2$  for the sample is 49;  $\bar{x}$  for the sample is calculated as 104. Which of the following should be used for calculating a 95 percent confidence interval for  $\mu$ ?
- Student's  $t$  distribution.
  - Normal distribution.
  - Finite population multiplier.
  - (a) and (c) but not (b).
  - (b) and (c) but not (a).
- A B C D** 33. We can use the normal distribution to represent the sampling distribution of the population when:
- The sample size is more than 10.
  - The sample size is less than 50.
  - The sample size is more than 5.
  - None of these.



34. If a statistic underestimates a population parameter as much as it overestimates it, we would call it:
- Consistent.
  - Sufficient.
  - Efficient.
  - All of these.
  - None of these.
35. If population proportion information is unknown, the standard error of the proportion can be estimated by the formula:
- $\sqrt{npq}$ .
  - $\sqrt{n\bar{p}\bar{q}}$ .
  - $\sqrt{pq/n}$ .
  - $\sqrt{\bar{p}\bar{q}/n}$ .
36. The average height of the 25 students in Mr. Stanton's tenth grade math class is known to be 66". In constructing a 95 percent confidence interval for the average height of all tenth graders, we would use:
- The normal distribution with 24 degrees of freedom.
  - The  $t$  distribution with 24 degrees of freedom.
  - The  $t$  distribution with 65 degrees of freedom.
  - The  $t$  distribution with 25 degrees of freedom.
37. A certain normally distributed population has a known standard deviation of 1.0. What is the total width of a 95 percent confidence interval for the population mean?
- 1.96.
  - 0.98.
  - 3.92.
  - It cannot be determined from the information given.
38. A single number used to estimate an unknown population parameter is a(n) \_\_\_\_\_ estimate.
39. A range of values used to estimate an unknown population parameter is a(n) \_\_\_\_\_ estimate.
40. Once we know something about a sample, the number of values in the sample we can specify freely is called \_\_\_\_\_.
41. The family of probability distributions used when the population standard deviation is unknown, the sample size is small, and the values approximate the normal is the \_\_\_\_\_.
42. When we give an interval estimate of a population parameter, we show how sure we are that the interval contains the actual population parameter by setting a \_\_\_\_\_ level.
43. The upper confidence limit and the lower confidence limit are the same \_\_\_\_\_ from the \_\_\_\_\_.
44. Theoretically, the \_\_\_\_\_ distribution is the correct distribution to use in constructing confidence intervals to estimate a population proportion.
45. In the absence of additional information, a value of \_\_\_\_\_ should be used for  $p$  when determining a sample size for estimating a population proportion.