

## Exercises 9–2

- What are the properties of the  $t$  distribution?
- What is meant by *degrees of freedom*?
- When should the  $t$  distribution be used to find a confidence interval for the mean? **The  $t$  distribution should be used when  $\sigma$  is unknown.**
- (ans) Find the values for each.
  - $t_{\alpha/2}$  and  $n = 18$  for the 99% confidence interval for the mean **2.898**
  - $t_{\alpha/2}$  and  $n = 23$  for the 95% confidence interval for the mean **2.074**
  - $t_{\alpha/2}$  and  $n = 15$  for the 98% confidence interval for the mean **2.624**
  - $t_{\alpha/2}$  and  $n = 10$  for the 90% confidence interval for the mean **1.833**
  - $t_{\alpha/2}$  and  $n = 20$  for the 95% confidence interval for the mean **2.093**

For Exercises 5 through 20, assume that all variables are approximately normally distributed.

- Visits to Networking Sites** A sample of 10 networking sites for a specific month has a mean of 26.1 and a standard deviation of 4.2. Find the 99% confidence interval of the true mean.  **$21.8 < \mu < 30.4$**



- Digital Camera Prices** The prices (in dollars) for a particular model of digital camera with 6.0 megapixels and an optical 3X zoom lens are shown below for 10 online retailers. Estimate the true mean price for this particular model with 95% confidence.  **$205.2 < \mu < 230.2$ . Assume the variable is normally distributed.**  
225 240 215 206 211 210 193 250 225 202



- Women Representatives in State Legislature** A state representative wishes to estimate the mean number of women representatives per state legislature. A random sample of 17 states is selected, and the number of women representatives is shown. Based on the sample, what is the point estimate of the mean? Find the 90% confidence interval of the mean population. (Note: The population mean is actually 31.72, or about 32.) Compare this value to the point estimate and the confidence interval. There is something unusual about the data. Describe it and state how it would affect the confidence interval.

|    |     |    |    |    |
|----|-----|----|----|----|
| 5  | 33  | 35 | 37 | 24 |
| 31 | 16  | 45 | 19 | 13 |
| 18 | 29  | 15 | 39 | 18 |
| 58 | 132 |    |    |    |



- State Gasoline Taxes** A random sample of state gasoline taxes (in cents) is shown here for 12 states. Use the data to estimate the true population mean gasoline tax with 90% confidence. Does your interval contain the national average of 44.7 cents?  **$38.70 < \mu < 48.28$ . Assume normal distribution; yes.**

|      |      |      |      |      |      |
|------|------|------|------|------|------|
| 38.4 | 40.9 | 67   | 32.5 | 51.5 | 43.4 |
| 38   | 43.4 | 50.7 | 35.4 | 39.3 | 41.4 |

Source: <http://www.api.org/statistics/fueltaxes/>

- Workplace Homicides** A sample of six recent years had an average of 573.8 workplace homicides per year with a standard deviation of 46.8. Find the 99% confidence interval of the true mean of all workplace homicides per year. If in a certain year there were 625 homicides, would this be considered unusually high?

Source: Based on statistics from the Bureau of Labor Statistics.



- Dance Company Students** The number of students who belong to the dance company at each of several randomly selected small universities is shown below. Estimate the true population mean size of a university dance company with 99% confidence.  **$25.8 < \mu < 33.9$ . Assume normal distribution.**

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 21 | 25 | 32 | 22 | 28 | 30 | 29 | 30 |
| 47 | 26 | 35 | 26 | 35 | 26 | 28 | 28 |
| 32 | 27 | 40 |    |    |    |    |    |

- Distance Traveled to Work** A recent study of 28 employees of XYZ company showed that the mean of the distance they traveled to work was 14.3 miles. The standard deviation of the sample mean was 2 miles. Find the 95% confidence interval of the true mean. If a manager wanted to be sure that most of his employees would not be late, how much time would he suggest they allow for the commute if the average speed were 30 miles per hour?  **$13.5 < \mu < 15.1$ ; about 30 minutes.**
- Thunderstorm Speeds** A meteorologist who sampled 13 thunderstorms found that the average speed at which they traveled across a certain state was 15 miles per hour. The standard deviation of the sample was 1.7 miles per hour. Find the 99% confidence interval of the mean. If a meteorologist wanted to use the highest speed to predict the times it would take storms to travel across the state in order to issue warnings, what figure would she likely use?  **$13.6 < \mu < 16.4$ ; 16.4 miles per hour**
- Students per Teacher in U.S. Public Schools** The national average for the number of students per teacher for all U.S. public schools is 15.9. A random sample of 12 school districts from a moderately populated area showed that the mean number of students per teacher was 19.2 with a variance of 4.41. Estimate the true mean number of students per teacher with 95% confidence. How does your estimate compare with the national average?  
Source: *World Almanac*.  **$17.87 < \mu < 20.53$ . Assume normal distribution; it's higher.**
- Social Networking Sites** A recent survey of 8 social networking sites has a mean of 13.1 million visitors for a specific month. The standard deviation was 4.1 million. Find the 95% confidence interval of the true mean.  
Source: ComScore Media Matrix.  **$9.7 < \mu < 16.5$**
- Chicago Commuters** A sample of 14 commuters in Chicago showed the average of the commuting times was 33.2 minutes. If the standard deviation was 8.3 minutes, find the 95% confidence interval of the true mean.  
Source: U.S. Census Bureau.  **$28.4 < \mu < 38.0$**