## Using Confidence Intervals for Hypothesis Tests

A confidence interval can be used to *test some claim* made about a population mean $\mu$. Formal methods of hypothesis testing are introduced in Chapter 8, and those methods might require adjustments to confidence intervals that are not described in this chapter. (We might need to construct a one-sided confidence interval or adjust the confidence level by using 90% instead of 95%.)

**CAUTION** Know that in this chapter, when we use a confidence interval to address a claim about a population mean $\mu$, we are making an *informal judgment* (that may or may not be consistent with formal methods of hypothesis testing introduced in Chapter 8).

### Example 2 Constructing a Confidence Interval: Highway Speeds

Listed below are speeds (mi/h) measured from southbound traffic on I-280 near Cupertino, California (based on data from SigAlert). This simple random sample was obtained at 3:30 P.M. on a weekday. The speed limit for this road is 65 mi/h. Use the sample data to construct a 95% confidence interval for the mean speed. What does the confidence interval suggest about the speed limit?

62 61 61 57 61 54 59 58 59 69 60 67

### Solution

**Requirement check** We must first verify that the requirements are satisfied. (1) The sample is a simple random sample. (2) The accompanying dotplot shows that the speeds have a distribution that is not dramatically different from a normal distribution, so the requirement that "the population is normally distributed or $n > 30$" is satisfied. ✓


**Using Technology** Technology can be used to automatically construct the confidence interval. (See instructions near the end of this section.) Shown here is the Minitab display resulting from the list of 12 sample highway speeds. The confidence interval is expressed in the format of (58.08, 63.26).

**MINITAB**

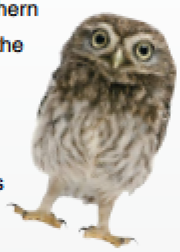
```
One-Sample T: Speeds

Variable   N   Mean  StDev  SE Mean       95% CI
Speeds    12  60.67   4.08     1.18  (58.08, 63.26)
```

**Using a $t$ Distribution Table** Using the listed sample values, we find that $n = 12$, $\bar{x} = 60.7$ mi/h, and $s = 4.1$ mi/h. For a confidence level of 95% and 11 degrees of freedom, the critical value is $t_{0.025} = 2.201$ as shown in Example 1. We now find the margin of error $E$ as shown here:

$$E = t_{\alpha/2}\frac{s}{\sqrt{n}} = 2.201 \cdot \frac{4.1}{\sqrt{12}} = 2.60503$$

### Estimating Wildlife Population Sizes

The National Forest Management Act protects endangered species, including the northern spotted owl, with the result that the forestry industry was not allowed to cut vast regions of trees in the Pacific Northwest.



Biologists and statisticians were asked to analyze the problem, and they concluded that survival rates and population sizes were decreasing for the female owls, known to play an important role in species survival. Biologists and statisticians also studied salmon in the Snake and Columbia Rivers in Washington State, and penguins in New Zealand. In the article "Sampling Wildlife Populations" (*Chance*, Vol. 9, No. 2), authors Bryan Manly and Lyman McDonald comment that in such studies, "biologists gain through the use of modeling skills that are the hallmark of good statistics. Statisticians gain by being introduced to the reality of problems by biologists who know what the crucial issues are."