**8.1 Confidence Intervals: The Basics**

In Chapter 7, we pretended to know the truth (e.g. ) and asked questions about the possible values of . In this chapter, we start getting real—we begin with what we actually know (e.g. ) and ask questions about the possible values of .

**Point estimate –** Our “best guess” at the value of an unknown parameter. It is called a point estimate because it is one specific value.

**The Idea of a Confidence Interval (http://www.rossmanchance.com/applets/ConfSim.html)**

According to a Gallup poll published on January 9, 2013, a 95% confidence interval for the true proportion of American adults who support the death penalty is 63% ± 4%. This estimate was based on a random sample of 1038 American adults.

A **confidence interval**, is an interval of plausible values for a parameter; point estimate  M.E. (Margin of Error)..

We can say: “We are 95% confident that the interval from \_\_ to \_\_ contains the true \_\_.”

**95% of the confidence intervals constructed will cover the true (unknown) population parameter**



**Confidence interval, margin of error, confidence level:**

**Confidence interval** for a parameter has two parts:

                        Estimate margin of error

**Margin of error –** Tells how close the estimate tends to be to the unknown parameter in repeated sampling.

1. The margin of error is added and subtracted from the point estimate to create a confidence interval with the desired level of confidence.
2. Accounts for variability due ONLY to random selection or random assignment; it does not compensate for any bias in the data collection.
3. Gets smaller when:
   1. The confidence level decreases (Less precise)
   2. The sample size n increases (Costs more $)

**Confidence level C –** Gives the overall success rate of the method for calculating the confidence interval. That is, in C% of all possible samples, the method would yield an interval that captures the true parameter value.

a.     **Confidence level –** To say that we are 95% confident is shorthand for “95% of the all possible samples of a given size from this population will result in an interval that captures the unknown parameter”

a.   DOES NOT tell us the chance that a particular confidence interval captures the population parameter. Do not interpret it as, “There is a 95% chance that the population parameter …….”

b.     **Confidence Interval –** To interpret a C% confidence interval for an unknown parameter, say. “We are C% confident that the interval from  \_\_\_\_\_ to  \_\_\_\_\_ captures the actual value of the [population parameter in context]. In practice, we tend to calculate only a single confidence interval for a given situation.

 What happens to the interval and M.E. if you increase your confidence level?

What happens to the interval and M.E. if you decrease your confidence level?

**Calculating a Confidence Interval:**

Statistic  (critical value)(standard deviation of statistic)

z-score corresponding to confidence level

**Three conditions for constructing a Confidence Interval:**

1. **Random –** The data come from a well-designed random sample
2. **Normal –** The sampling distribution of the statistic is approximately Normal
   1. *For means -*  or population normal
   2. *For proportions -*  and 
3. **Independent –** Individual observations are independent. When sampling without replacement, check the 10% condition.

**Example**

A consumer watchdog organization estimates the mean weight of 1-ounce “Fun-Size” candy bars to see if customers are getting full value for their money. A random sample of 25 bars is selected and weighed, and the organization reports that a 90% confidence interval for the true mean weight of the candy bars is 0.992 to 0.998 ounces.

1. What is the point estimate from this sample?
2. What is the margin of error?
3. Interpret the 90% confidence *interval* 0.992 to 0.998 in the context of the problem.
4. Interpret the confidence *level* of 90% in the context of the problem.
5. Based on the interval, is there convincing evidence that the weight of a candy bar is less than 1 ounce, on average? Explain.

**Example**

A manufacturer of flashlights wants to know how well one of their newer styles is selling in a chain of large home-improvement stores. They select a simple random sample of 20 stores, record how many of the flashlights were sold in a 30-day period, and construct a 95% confidence interval for the mean number of flashlights sold.

1. Discuss whether this study meets the necessary conditions for constructing a confidence interval. If

you think one of the conditions has not been met, what additional information would be required or what change in the study would you recommend?

1. If, instead of constructing a 95% confidence interval, the flashlight manufacturer constructed a 98%

confidence interval, would the 98% interval be wider, narrower, or the same width as the 95% interval? Explain.

1. How would the width of confidence interval change if the flashlight manufacturer took a

larger sample? Explain.