Section 7.1 Margins of Error and Estimates

Estimation (single value or range of values) is the process of determining the value of a population **parameter** from the evidence made available by a sample **statistic**. Loosely speaking, an estimation is a "good guess".

A **point estimate** is a single value that has been calculated from sample data to estimate the unknown population parameter.

For example, say we want to know the average height of men in a certain city. If we take a good SRS and find the height is 5 feet 10 inches, then this point estimate would be our "good estimate" for the population.

Population Parameter	Sample Statistic
<i>p</i> - Population Proportion	\hat{p} - Sample Proportion
μ - Population Mean	\overline{x} - Sample Mean
σ - Population Standard Deviation	s – Sample Standard Deviation

Suppose we would like to make an estimate of a population parameter based on a sample statistic. A **confidence interval** is a range of possible values that is likely to contain the unknown population parameter that we are seeking. We'll use this to estimate things about our population.

The more confident you are, the larger the range (width). The less confident you are, the smaller the range (width).

The mean is always the center of the confidence interval.

nterval centered at 15?

Example 1: Which of the following is NOT a valid confidence interval centered at 15? a. [10, 20] b. [0, 30] c. [0, 15]

First, we must have a **level of confidence**. Then, based on this level, we will compute a **margin of error** (we will discuss how to compute this in the next sections; it'll use the standard deviation and level of confidence). Last, we can say that we are --% confident that the true population parameter falls within our confidence interval.

Formula for a confidence interval is sample statistic ± margin of error

For example, in the men's height example above the sample statistic would be 5 feet 10 inches. Then the margin of error would come from the standard deviation and level of confidence.

What does the level of confidence actually mean?

Let's use our men's height example again. Let's say the confidence interval was [a, b] and that the level of confidence is 90%. This mean that if we were to repeat samples and find the average height for each sample taken, then 90% of those samples would contain the population mean.

Example 2: A poll was conducted on a sample of families in a certain school district to determine if they favored a four-day school week. It was found that 85% of the families favored such a change. If the margin of error is $\pm 2\%$ with a 90% confidence level, find and interpret the confidence interval.

 $\hat{p} = .85$ M.E. = .02 margin of error [.85-0.02 , .85+0.02] Confidence Interval: = [0.83,0.87] 90% confident that the true proportion of families that favor the change fall between 83% & 87%

What does the confidence level of 90% mean?

a. 90% chance that the district will change to a four-day school week.

b. 90% chance that the proportion is within the confidence level.

c. 90% of all samples taken contain the population proportion.

Interpret the confidence interval.

In this section we did confidence intervals around sample proportions, but we can also do them around sample means, variances, regressions lines, etc.