7.6: Sample Size for a Mean

Often, we need a specific confidence level, but we need our margin of error to be within a set range. We are able to accomplish this by increasing the sample size. However, taking large samples is often difficult or costly to accomplish. Thus, it is useful to be able to determine the minimum sample size necessary to achieve our confidence interval.

> A confidence interval for a population mean μ with specific margin of error E and known population standard deviation σ is given by, $n=\left(\frac{z_{\alpha/2}\cdot\sigma}{E}\right)^2$.
>
> Always round up to the next whole number.

Keep in mind that we rarely know the value of the population standard deviation. We can estimate σ by using a previous year's standard deviation or a standard deviation from a similar study, a pilot sample, or by dividing the range by 4.

> A researcher is interested in estimating the average salary of teachers. She wants to be 95% confident that her estimate is correct. In a previous study, she found the population standard deviation was $1,175. How large a sample is needed to be accurate within $100?
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> **Solution**
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> First find the $z_{\alpha/2}$ for 95% confidence using Excel or your calculator, so $z_{\alpha/2}$ = 1.96. Most of the time the margin of error = E follows the word "within" in the question, E = 100. The standard deviation σ = 1175. Replace each number into the formula: $n=\left(\frac{1.96\cdot 1175}{100}\right)^2=530.38$. If we round down, we would not get "within" the $100 margin of error. Always round sample sizes up to the next whole number so that your margin of error will be within the specified amount. The larger the sample size, the smaller the confidence interval. The answer is n = 531.