Ch 6.4 Finding the sample size

Sample Size for Estimating Mean μ

$$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

(solve for n by algebra)

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

Formula 6-3

$z_{\alpha/2}$ = critical z score based on the desired degree of confidence
E = desired margin of error
σ = population standard deviation

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Round-Off Rule for Sample Size n

When finding the sample size n, if the use of Formula 6-3 does not result in a whole number, always *increase* the value of n to the next *larger* whole number.

n = 216.09 = 217 (rounded up)

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Example: If we want to estimate the mean weight of plastic discarded by households in one week, how many households must be randomly selected to be 99% confident that the sample mean is within 0.25 lb of the true population mean? (A previous study indicates the standard deviation is 1.065 lb.)

$\alpha = 0.01$
$z_{\alpha/2} = 2.575$
$E = 0.25$
$s = 1.065$

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

$$= \left[\frac{(2.575)(1.065)}{0.25}\right]^2$$

= 120.3 = 121 households

We would need to randomly select 121 households and obtain the average weight of plastic discarded in one week. We would be 99% confident that this mean is within 1/4 lb of the population mean.

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Ex1b). Scores on a certain test are normally distributed with a ***variance*** of 15. A researcher wishes to estimate the mean score achieved by all students on the test. Find the sample size needed to assure 98% confidence that the sample mean will not differ from the population mean by more than 4 units.

$Z_{\alpha/2}$ =
E =
σ =

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

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Try)You want to find the mean IQ scores of a statistics professor. If you want to be 95% confident and have an error of 2 points of the true population mean and a standard deviation of 15, how many professors would you have to survey?

$Z_{\alpha/2}$ =
E =
σ =

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

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What if σ is Not Known ?

1. Use the range rule of thumb to estimate the standard deviation as follows: $\sigma \approx \frac{\text{range}}{4}$

2. Conduct a pilot study by starting the sampling process. Based on the first collection of at least 31 randomly selected sample values, calculate the sample standard deviation *s* and use it in place of σ. That value can be refined as more sample data are obtained.

3. Estimate the value of σ by using the results of some other study that was done earlier.

- **Larger errors allow smaller samples.**
- **Smaller errors require larger samples.**

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Ex2a) Using the range rule of thumb determine how many college textbooks you need if α = .01, you want to be within $3 of the mean, and notice prices range from $10 - $90?

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

$Z_{\alpha/2}$ =

E =

σ =

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Ex2b) How many teachers would you have to survey to determine the average salary? If you know the starting salary for a teacher is 29,750 and the highest is $69,250. You also want to be with in $2000 of the mean and be 95% confident in your findings.

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

$Z_{\alpha/2}$ =

E =

σ =

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