Unit 3: Foundations for inference

2. Confidence intervals

GOVT 3990 - Spring 2020

Cornell University

Outline

1. Main ideas

    1. Statistical inference methods based on the CLT depend on the same conditions as the CLT
    2. Use confidence intervals to estimate population parameters
    3. Critical value depends on the confidence level
    4. Calculate the sample size a priori to achieve desired margin of error

2. Summary

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1. Statistical inference methods based on the CLT depend on the same conditions as the CLT

Always check these in context of the data and the research question!

1. *Independence:* Sampled observations must be independent.
   * This is difficult to verify, but is more likely if
     - random sampling/assignment is used, and,
     - if sampling without replacement, $n <$ 10% of the population.
2. *Sample size/skew:* Either the population distribution is normal or $n > 30$ and the population distribution is not extremely skewed (the more skewed the distribution, the higher n necessary for the CLT to apply).
   * This is also difficult to verify for the population, but we can check it using the sample data, and assume that the sample mirrors the population.

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2. Use confidence intervals to estimate population parameters

$$CI : point\ estimate \pm margin\ of\ error$$

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If the parameter of interest is the population mean, and the point estimate is the sample mean,

$$\bar{x} \pm Z^{\star}\frac{s}{\sqrt{n}}$$

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3. Critical value depends on the confidence level

Your turn

What is the critical value ($Z^\star$) for a confidence interval at the 91% confidence level?

(a) $Z^\star = 1.34$

(b) $Z^\star = 1.65$

(c) $Z^\star = 1.70$

(d) $Z^\star = 1.96$

(e) $Z^\star = 2.33$

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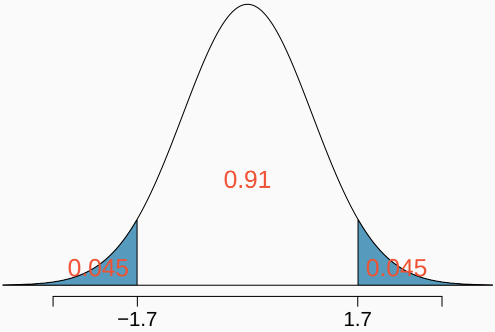

Common misconceptions about confidence intervals

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3. A wider interval means less confidence.
   This is incorrect since it is possible to make very precise statements with very little confidence.

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4. Calculate the sample size a priori to achieve desired margin of error

$$ME = z^{\star} \frac{s}{\sqrt{n}}$$

So if we know the desired ME, and confidence level (and hence $z^{\star}$), and the sample standard deviation, we can solve for n.

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$$n = (\frac{z \star s}{ME})^2$$

Application exercise: 3.1 Confidence interval for a single mean

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