Confidence Interval

- Conceptual understanding
- Examples
- Stylized problem

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Confidence Interval

A (1 - α) confidence interval for the population mean…

$$\bar{x} - |z_{\alpha/2}|\frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + |z_{\alpha/2}|\frac{\sigma}{\sqrt{n}}$$

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$$\bar{x} - |z_{\alpha/2}| \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + |z_{\alpha/2}| \frac{\sigma}{\sqrt{n}}$$

$z_{\alpha/2}$ **= NORM.INV(α/2, 0, 1)**

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$$\bar{x} - \underbrace{\left|z_{\alpha/2}\right| \frac{\sigma}{\sqrt{n}}}_{\text{margin of error}} < \mu < \bar{x} + \left|z_{\alpha/2}\right| \frac{\sigma}{\sqrt{n}}$$

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$$\bar{x} - |z_{\alpha/2}|\frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + |z_{\alpha/2}|\frac{\sigma}{\sqrt{n}}$$

margin of error = CONFIDENCE.NORM(α, σ, n)

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Lower limit

Upper limit

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$$\underbrace{\bar{x} - \left|z_{\alpha/2}\right| \frac{\sigma}{\sqrt{n}}}_{\text{Lower limit}} \quad < \quad \mu \quad < \quad \underbrace{\bar{x} + \left|z_{\alpha/2}\right| \frac{\sigma}{\sqrt{n}}}_{\text{Upper limit}}$$

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Upper limit

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When the population standard deviation (σ) is not known,

- we replace it by the ***sample standard deviation (s)***
- The z-statistic ($z_{\alpha/2}$) gets replaced by the ***t*-statistic ($t_{\alpha/2}$)**

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A (1 - α) confidence interval for the population mean…

$$\bar{x} - |t_{\alpha/2}|\frac{s}{\sqrt{n}} < \mu < \bar{x} + |t_{\alpha/2}|\frac{s}{\sqrt{n}}$$

When the population standard deviation (σ) is not known,

- we replace it by the ***sample standard deviation*** **(*s*)**
- The z-statistic ($z_{\alpha/2}$) gets replaced by the ***t*-statistic** **($t_{\alpha/2}$)**

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$t_{\alpha/2}$ **= T.INV(α/2, n-1)**

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Confidence Interval

Example

A person wishes to explore the size of single family houses that are typically available for purchase in a particular neighborhood of Houston in Texas. She manages to get hold of a list containing house sizes of a sample of 100 houses that were sold in the past two years.
The data is provided in the excel data file Home_Sizes.xlsx, and given this data she wishes to assess the average size of houses typically available for purchase in this neighborhood.

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A 95% confidence interval for the average (population mean) house size:

[3048.2, 3428.3] square feet