The *z* statistic and the *t* statistic

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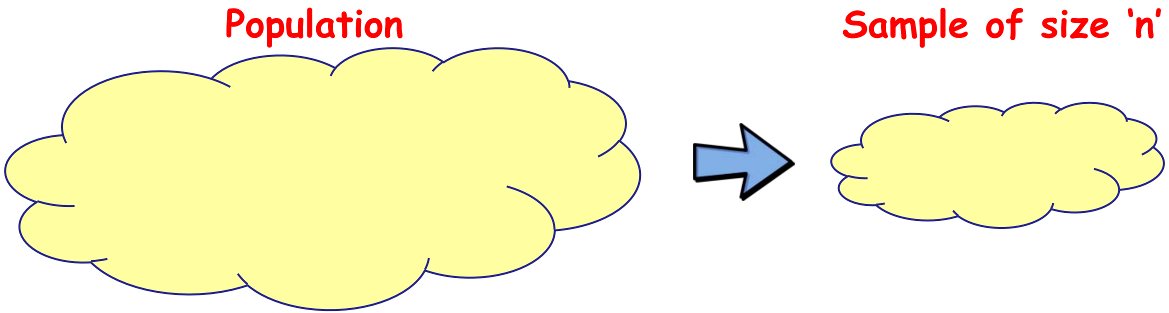
Central Limit Theorem



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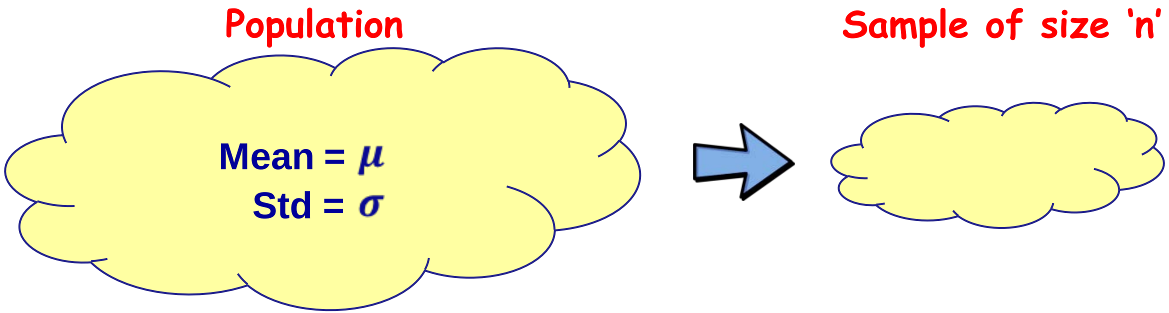

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Central Limit Theorem

Population

Mean = μ

Std = σ

Sample of size 'n'

$$\bar{x} \sim \text{Normal}(\mu, \frac{\sigma}{\sqrt{n}})$$

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$$\bar{x} \sim \text{Normal}\left(\mu, \frac{\sigma}{\sqrt{n}}\right) \quad \Rightarrow \quad \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \sim \text{Normal}(0,1)$$

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z-statistic

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$$\text{z-statistic} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \sim \text{Normal}(0, 1)$$

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Need to know σ to use the z-statistic

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A more realistic scenario is where the population standard deviation σ is not known

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$$\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

Replace with s, the sample standard deviation $\Rightarrow$

$$\frac{\bar{x} - \mu}{s/\sqrt{n}}$$

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Replace with s, the sample standard deviation

$$\Rightarrow \quad \frac{\bar{x} - \mu}{s / \sqrt{n}} \sim \cancel{\text{Normal}}(0, 1)$$

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$$\Rightarrow \quad \frac{\bar{x} - \mu}{s/\sqrt{n}} \sim \cancel{\text{Normal}(0,1)}$$

$$\sim t_{n-1} \quad \checkmark$$

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$$\text{t-statistic} = \frac{\bar{x} - \mu}{s/\sqrt{n}} \sim t_{n-1}$$

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