INTERVAL ESTIMATION – ONE SAMPLE FORMULAS

1 -Confidence Intervals

Interval estimation of a population mean μ when σ is known

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

where $z_{\frac{\alpha}{2}}$ is the $\frac{\alpha}{2}$ critical value for a z- distribution. *The confidence interval is exact for normal populations and is approximately correct for large samples of non normal populations*

Interval estimation of a population mean μ when σ is unknown

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

Where $t_{\frac{\alpha}{2}}$ is the $\frac{\alpha}{2}$ critical value for a t-distribution with n-1 degrees of freedom. *The confidence interval is exact for normal populations and is approximately correct for large samples of non normal populations*

Interval estimation of a population proportion

$$\hat{p} - z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}} \prec p \prec \hat{p} + z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

where $\hat{p} = \frac{x}{n}$ is the sample proportion and $\hat{q} = 1 - \hat{p}$. *Assumption: the number of successes, x, and the number of failures, n-x, are both greater than 5*

Interval estimation of a population variance

$$\frac{(n-1).s^2}{\chi_R^2} \prec \sigma^2 \prec \frac{(n-1).s^2}{\chi_L^2}$$

where χ_L^2 and χ_R^2 denote respectively the left and right-tailed critical values of the χ^2 distribution with n-1 degrees of freedom. *The confidence interval is exact for normal populations and is approximately correct for large samples of non normal populations.*

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2. Minimum Sample size for margin of error E

Minimum sample size for estimating a population mean μ

$$n = \left(\frac{z_{\frac{\alpha}{2}} \cdot \sigma}{E} \right)^2$$

(Rounded up to the nearest whole number)

Minimum sample size for estimating a population proportion p

$$n = \frac{z_{\frac{\alpha}{2}}^2 . (.25)}{E^2}$$

(Rounded up to the nearest whole number)

Used when there is no idea about p magnitude

$$n = \frac{z_{\frac{\alpha}{2}}^2 . p_g . q_g}{E^2}$$

(Rounded up to the nearest whole number)

where the "g" means an "educated guess" about the values