6D Summary

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6D Summary and Formulas

[ToC]

D.1 Sampling distribution of sample mean

- If X_i are random sample from normal distribution with mean μ and SD σ,

$$\bar{X} \sim N\big(\mu, \sigma^2/n\big)$$

- If $n > 40$, then above is approximately true even if it is not from the normal distribution. (e.g. Exponential Distribution)

- If $np > 10$ and $n(1-p) > 10$ are both true, same goes for proportionn estimator

$$\bar{X} = \hat{p} \sim N\big(\mu, \sigma^2/n\big) = N\big(p, p(1-p)/n\big)$$

D.2 Confidence Interval

- Above result leads to $100(1-\alpha)\%$ two-sided Confidence Interval for μ,

$$\bar{X} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$$

- And $100(1-\alpha)\%$ two-sided Confidence Interval for p,

$$\hat{p} \pm z_{\frac{\alpha}{2}} \frac{p(1-p)}{\sqrt{n}}$$

- If σ is not known, replace with sample standard deviation S, and change $z_{\frac{\alpha}{2}}$ to $t_{\frac{\alpha}{2},n-1}$.

- For one-sided upper- or lower-bound CI, pick $+$ or $-$ sign, and change $\frac{\alpha}{2}$ to α.

D.3 Sample Variance

- Sampling distribution of the sample variance

$$(n-1)S^2/\sigma^2 \sim \chi^2(n-1)$$

- $100(1-\alpha)\%$ two-sided Confidence Intervals for σ^2

$$\left(\frac{(n-1)S^2}{\chi^2_{\frac{\alpha}{2},n-1}}, \; \frac{(n-1)S^2}{\chi^2_{1-\frac{\alpha}{2},n-1}} \right)$$

- For one-sided CI, take one of them, and change $\alpha/2$ to α.

- For CI for σ, take squareroot of above formulas.