Chapter 9 Review (Only 9.1 & 9.2)

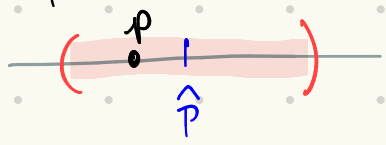
CONFIDENCE INTERVALS

inferential statistics

Population Proportion

Goal estimate population proportion p w/ an interval

↳ using a sample proportion $\hat{p}$



CI $\hat{p} - E < p < \hat{p} + E$ or $(\hat{p} - E, \hat{p} + E)$

key Terms

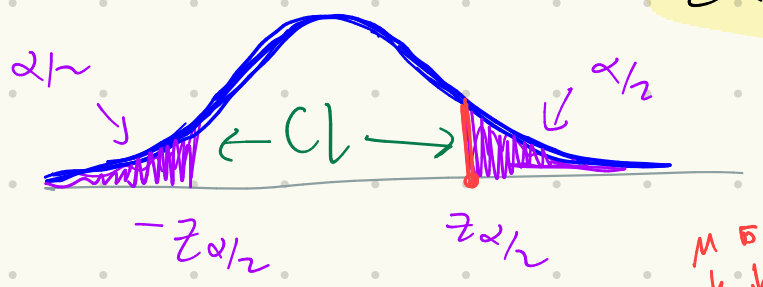
- point estimate : $\hat{p} = x/n$
- critical value : $z_{\alpha/2}$
- margin of Error : E

How to construct CI

① start w/ point estimate: $\hat{p}$ (also $\hat{q} = 1 - \hat{p}$)

↳ check requirement $n \cdot \hat{p} \cdot \hat{q} \geq 10$ & SRS & Indep

② Find critical value: $z_{\alpha/2}$



→ • CL
• $\alpha = 1 - CL$
• $\alpha/2$

$\Rightarrow z_{\alpha/2} = \text{invNorm}\left(\frac{\alpha}{2}, 0, 1, \text{RIGHT}\right)$ (M, SD, Tail)

* USE NORMAL DIST / z-dist *

③ Find Error

$$E = z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

④ Find CI

Compute $\hat{p} \pm E$ & write CI:

$$(\hat{p} - E, \hat{p} + E)$$

Estimating Sample Size

Sample $\hat{p}$ known

$$n = \frac{(z_{\alpha/2})^2 \cdot \hat{p}\,\hat{q}}{E^2}$$

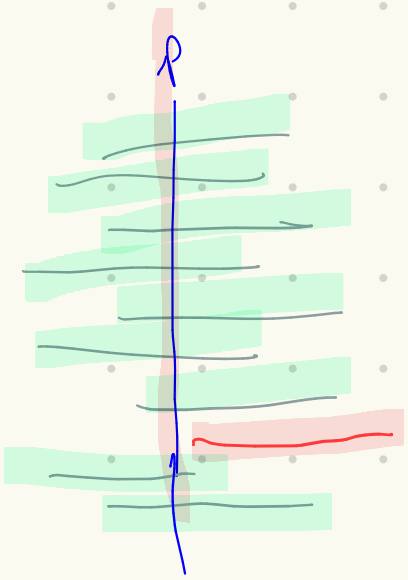
$\hat{p}$ unknown

$$n = \frac{(z_{\alpha/2})^2}{4E^2} \quad \left(\text{alternative } = \frac{(z_{\alpha/2})^2 \cdot 0.25}{E^2}\right)$$

Template "Interpretation" (M→E)

#1 "We are 62% confident that the true population proportion of GCC students that favor online learning is between 0.7 & 0.9."

#2 "If we took 100 samples and constructed 100 corresponding confidence intervals, then CL out of 100 of them will contain the true population proportion"



$\hat{p}_1$ $\hat{p}_2$ $\hat{p}_3$ $\hat{p}_4$ $\hat{p}_5$ $\hat{p}_6$ ..... $\hat{p}_{100}$

↓ ↓ ↓

CI CI CI

CL = 90% = 0.9

so 90 CI contain pop. prop.

9.2 CI for Population MEAN

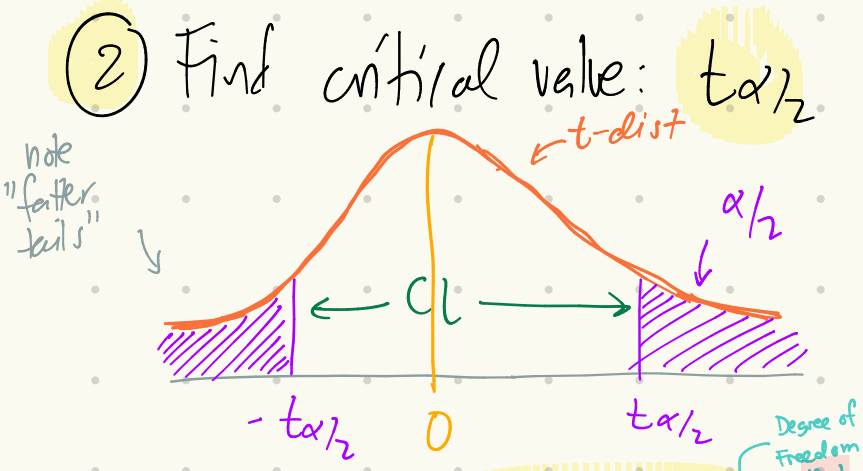
"MR T IS MEAN"
↳ USE t-distribution

CI for Mean $\bar{x} - E < \mu < \bar{x} + E$ or $(\bar{x} - E, \bar{x} + E)$

How to construct

① Find point estimate : $\bar{x}$ (and also sample standard deviation s)
↳ check requirements : ① SRS ② indep ③ original distribution
- normal
- OR
- $n > 30$

② Find critical value: $t_{\alpha/2}$



- CL
- $\alpha = 1 - CL$
- $\alpha/2$

$\Rightarrow t_{\alpha/2} = |invT(\alpha/2, df)|$ (Degree of Freedom $n-1$)

(or $= invT(1-\alpha/2, df)$)

③ Error

$E = t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$

s = sample standard deviation

④ Find CI

Compute $\bar{x} \pm E$ & write

CI: $(\bar{x} - E, \bar{x} + E)$

Estimating Sample Size

$$n = \left(\frac{z_{\alpha/2} * s}{E}\right)^2$$

wait? why not using t-dist?
b/c we don't know n (we're trying to find this) so we use $z_{\alpha/2}$ as est.