Statistics

Lecture 23

Feb 19-8:47 AM

LA Times claim that less than 20% of all LA residents are fan of mail-in votes. $P < .2$ ↑ H_1

I surveyed 175 LA residents and 18% of them were fan of mail-in votes. $n = 175$ $\hat{P} = .18$

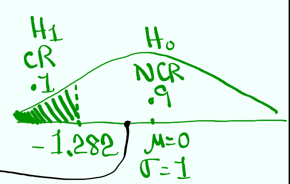
$x = n\hat{p} = 175(.18) = 31.5$ $\boxed{x = 32}$

Test the claim at $\alpha = .1$.

$H_0: P \geq .2$

$H_1: P < .2$ Claim, LTT

CV Z LTT $\alpha = .1$



$\boxed{\begin{array}{l} \text{CTS } Z = -.567 \\ \text{P-Value } P = .285 \end{array}}$

1-PropZTest

$Z = \text{invNorm}(.1, 0, 1)$

CTS is in NCR

P-Value $> \alpha$

H_0 valid, H_1 invalid Invalid claim

Reject the claim

May 27-1:48 PM

College claims the mean age of all professors is more than 50 Yrs. $\mu > 50$ ← H_1

In a Sample of 35 professors their mean age was 55 Yrs. $n = 35$ $\bar{x} = 55$

It is known that standard deviation of ages of all professors is 12 Yrs. $\sigma = 12$

No $\alpha \to .05$

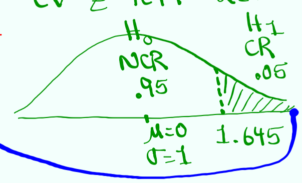
Test the claim.

σ Known

H_0: $\mu \leq 50$

H_1: $\mu > 50$ claim, RTT

CV Z RTT $\alpha = .05$



CTS $Z = 2.465$

P-Value $P = .007$

Z-Test

$Z = \text{invNorm}(.95, 0, 1)$

CTS is in CR
P-value $\leq \alpha$ ⇒ H_0 invalid, H_1 valid → Valid claim

FTR the claim

May 27-2:00 PM

10 exams were randomly Selected. Here are the Scores:

73 86 65 100 92

95 80 75 88 70

1) find

$\bar{x} \approx 82$

$S \approx 12$

Round to whole #

No $\alpha \to .05$

2) use this Sample to test the claim that the mean of all exam Scores is 80.

$\mu = 80$ ← H_0

H_0: $\mu = 80$ claim

σ unknown

H_1: $\mu \neq 80$ TTT

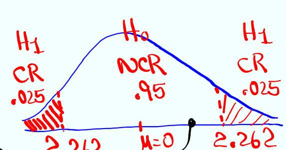
CV t TTT $\alpha = .05$

$df = n - 1 = 9$

CTS $t = .527$

P-Value $P = .611$ ✓

T-Test



σ unknown

$df = 9$

CTS is in NCR
P-Value $> \alpha$

H_0 Valid, H_1 invalid

Valid claim

$t = \text{invT}(.975, 9)$

FTR the claim

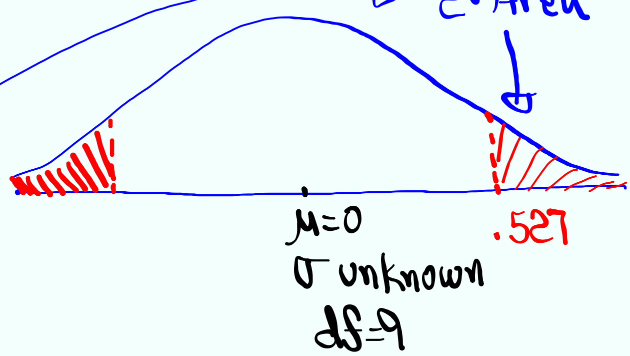
May 27-2:11 PM

CTS $t = .527$ $\rightarrow$ $2 \cdot$ Area

TTT

$df = 9$

Find P-Value



$$\text{P-value} = 2 \cdot \text{tcdf}(.527, E99, 9) \approx \boxed{.611}$$

May 27-2:23 PM

Use the chart below to test the claim that $\boxed{\sigma_1 = \sigma_2}$ $\rightarrow$ No α $\rightarrow$ .05

Group 1	Group 2
$n_1 = 6$	$n_2 = 10$
$S_1 = 12$	$S_2 = 8$

1) $S_1 > S_2$ ✓

2) CTS $F = \dfrac{S_1^2}{S_2^2} = \dfrac{12^2}{8^2} = \boxed{2.25}$

3) $Ndf = n_1 - 1 = 5$

$Ddf = n_2 - 1 = 9$

4) $H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

Use $\boxed{\text{2-SampF Test}}$

$\boxed{\begin{array}{l} \text{CTS } F = 2.25 \\ \text{P-Value } P = .274 \checkmark \end{array}}$

P-Value $> \alpha$

H_0 valid, H_1 invalid

Valid claim

FTR the claim

May 27-2:26 PM

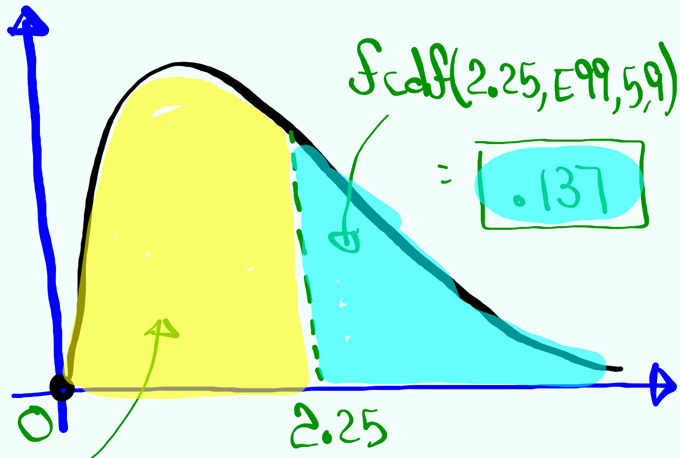
CTS $F=2.25$

TTT

$Ndf=5$

$Ddf=9$

Find P-Value



$\text{Fcdf}(2.25, E99, 5, 9) = \boxed{.137}$

$\text{Fcdf}(0, 2.25, 5, 9) = \boxed{.863}$

$\boxed{.274}$

P-Value = 2 · Smaller area = 2(.137)

May 27-2:34 PM

Females : $n=8$, $S=5$

Males : $n=6$, $S=2$

~~No α~~ → .05

Test the claim $\sigma_1 > \sigma_2$

Females	Males
$n_1=8$	$n_2=6$
$S_1=5$	$S_2=2$

$S_1 > S_2$

H_0: $\sigma_1 \le \sigma_2$

H_1: $\sigma_1 > \sigma_2$ claim RTT

Use 2-SampFTest

CTS $F=6.25$

P-Value $P=.030$

P-Value $\le \alpha$

H_0 invalid

H_1 valid → Valid claim

FTR

Suggest values for α that reverses the Conclusion. We need to reverse P-Value $\le \alpha$

So we want P-Value $> \alpha$

$.030 > \alpha$

→ choose α to be .02 or .01.

May 27-2:38 PM

SG 26

Working with two population Proportions:

Group 1	Group 2
$x_1 =$	$x_2 =$
$n_1 =$	$n_2 =$

$\hat{p}_1 = \frac{x_1}{n_2}$ $\hat{p}_2 = \frac{x_2}{n_2}$

Pooled Proportion $\bar{p}$

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

Females	Males
$x_1 = 12$	$x_2 = 8$
$n_1 = 40$	$n_2 = 60$

$\hat{p}_1 = \frac{12}{40} = .3$

$\hat{p}_2 = \frac{8}{60} \approx .13$

$\bar{p} = \frac{12+8}{40+60} = \frac{20}{100} = \boxed{.2}$

Confidence Interval for $p_1 - p_2$:

$\boxed{STAT} \to \boxed{TESTS} \downarrow \boxed{2\text{-PropZInt}}$

Find 98% Conf. interval for $p_1 - p_2$.

$\boxed{2\text{-PropZInt}}$

$\boxed{-.03 < p_1 - p_2 < .36}$

$E = \frac{.36 - (-.03)}{2} = \frac{.39}{2} = \boxed{.195}$

May 27-2:57 PM

In a Survey of 120 Females, 40% were nursing major.

$n = 120$, $\hat{p} = .4$ $\to x = n\hat{p} = 120(.4) = 48$

In a Survey of 80 males, 35% were nursing major.

$n = 80$, $\hat{p} = .35$ $\to x = n\hat{p} = 80(.35) = 28$

Females	Males
$x_1 = 48$	$x_2 = 28$
$n_1 = 120$	$n_2 = 80$

$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{48+28}{120+80} = \frac{76}{200} = \boxed{.38}$

NO C-level: .95

Find Conf. interval for the difference of two Pop. Proportions

2-Prop ZInt

$\boxed{-.09 < p_1 - p_2 < .19}$

$E = \frac{.19 - (-.09)}{2} = \boxed{.14}$

May 27-3:06 PM

Testing two Pop. Proportions:

$H_0: P_1 = P_2$	$H_0: P_1 \leq P_2$	$H_0: P_1 \geq P_2$
$H_1: P_1 \neq P_2$	$H_1: P_1 > P_2$	$H_1: P_1 < P_2$
TTT	RTT	LTT

CV Z → invNorm

CTS Z
P-Value P → 2-PropZTest

we proceed with testing chart

Final conclusion must be about claim.

Reject the claim OR FTR

May 27-3:14 PM

use the chart below to test the claim that $P_1 = P_2$.

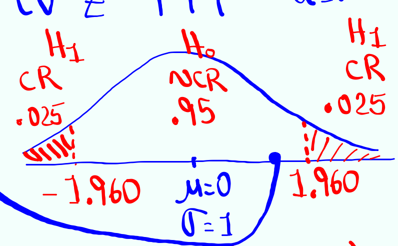
$H_0: P_1 = P_2$ claim

$H_1: P_1 \neq P_2$ TTT

Females	Males
$x_1 = 48$	$x_2 = 28$
$n_1 = 120$	$n_2 = 80$

No α → .05

CV Z TTT $\alpha = .05$



$Z = \text{invNorm}(.975, 0, 1)$

CTS $Z = .714$
P-Value $P = .475$

2-PropZTest

CTS is in NCR

P-Value > α

H_0 valid, H_1 invalid

Valid Claim

FTR the claim.

May 27-3:18 PM

In a Sample of 150 Females, 60% of them were in Support of tougher gun laws.

$n=150$, $\hat{p}=.6 \to x = n\hat{p} = 150(.6) = \boxed{90}$

In a Sample of 100 males, 50% of them were in Support of tougher gun laws.

$n=100$, $\hat{p}=.5 \to x = n\hat{p} = 100(.5) = \boxed{50}$

Females	Males
$x_1 = 90$	$x_2 = 50$
$n_1 = 150$	$n_2 = 100$

$\bar{p} = \dfrac{x_1 + x_2}{n_1 + n_2} = \dfrac{140}{250} = \boxed{.56}$

Find 90% Conf. interval for $P_1 - P_2$.

2-PropZInt

$\boxed{-.01 < P_1 - P_2 < .21}$

$E = \dfrac{.21 - (-.01)}{2} = \dfrac{.22}{2} = \boxed{.11}$

May 27-3:27 PM

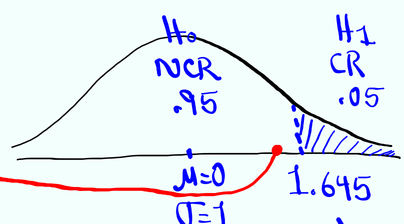
Test the claim that $P_1 > P_2$.

No $\alpha \to .05$

CV Z RTT $\alpha = .05$

$H_0: P_1 \le P_2$

$H_1: P_1 > P_2$ claim, RTT



$\boxed{\begin{array}{l} \text{CTS } Z = 1.560 \\ \text{P-value } P = .059 \end{array}}$

$Z = \text{invNorm}(.95, 0, 1)$

2-PropZTest

CTS is in NCR

$\boxed{\text{P-Value} > \alpha}$

H_0 Valid, H_1 invalid

Invalid claim

Reject the claim

Suggest values for α to reverse the Conclusion.

P-Value $\le \alpha$

$.059 \le \alpha$

choose .06, .07, .08, .09, .10, ...

May 27-3:34 PM