Statistics

Lecture 25

Feb 19-8:47 AM

LA Times reported that about 35% of all nurses work overtime.

$P = .35$ ← H_0

I took a sample of 75 nurses and 32% of them were working overtime.

$n = 75$

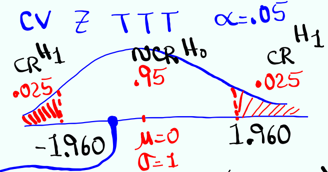
$\hat{p} = .32$ → $x = n\hat{p} = 75(.32) = 24$

Use my sample to test the validity of the report.

H_0: $P = .35$ claim

H_1: $P \neq .35$ TTT

CV Z TTT $\alpha = .05$



$Z_{.025} = \text{invNorm}(.975, 0, 1)$

CTS $Z = -.545$

P-Value $P = .586$

1-Prop Z Test

$P_0 = .35$

$x = 24$

$n = 75$

Prop $\neq P_0$

CTS is in NCR ⇒ H_0 Valid

P-Value > α ⇒ H_1 invalid

Valid claim

Valid Report

FTR the claim

May 13-6:55 PM

City of Monterey Park claims that the mean rent for all 2B2B apts. is below \$2500.

$\mu < 2500$ ← H_1

I randomly selected 30 of such apts, the mean rent was \$2400.

$n = 30$
$\bar{x} = 2400$

It is known that standard dev. of rents of all 2B2B in the city is \$250. $\sigma = 250$

Use $\alpha = .1$ to test the claim.

H_0: $\mu \geq 2500$

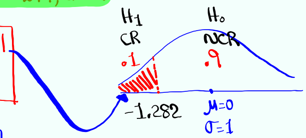
H_1: $\mu < 2500$ LTT, claim

σ known

CV z LTT $\alpha = .1$

CTS $z = -2.191$

P-Value $P = .014$



Z-Test

inpt: Stats

μ_0: 2500

σ: 250

$\bar{x}$ = 2400

n = 30

$\mu < \mu_0$

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

CTS is in CR ⇒ H_0 invalid

P-Value $\leq \alpha$ ⇒ H_1 valid

Valid claim

FTR the claim

Suggest a value for α that reverses the conclusion.

P-Value $> \alpha$

$.014 > \alpha$ → choose $\alpha = .01$

we reject the claim

May 13-7:07 PM

AAA claims the mean speed of all cars on FWY 60 is more than 70 mph.

$\mu > 70$ ← H_1

I took a sample of 15 cars, their mean speed was 72 mph with standard dev. of 10 mph.

H_0: $\mu \leq 70$

H_1: $\mu > 70$ claim, RTT

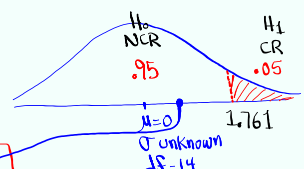
Test the claim. $n = 15$, $\bar{x} = 72$, $S = 10$

σ unknown

CV t RTT

No α → .05

$df = n - 1 = 14$



CTS $t = .775$

P-Value $P = .226$

$t = \text{invT}(.95, 14)$

T-Test

$\mu_0 = 70$

$\bar{x} = 72$

S = 10

n = 15

$\mu > \mu_0$

CTS is in NCR H_0 valid

P-Value $> \alpha$ ⇒ H_1 invalid

Invalid claim

Reject the claim

What α values suggest supporting the claim?

we need P-Value $\leq \alpha$

$.226 \leq \alpha$

Choose

$\alpha = .23, .24, .25, .26, \ldots$

May 13-7:23 PM

In a Sample of 80 Females, 50% of them were nursing majors.

$n=80$, $\hat{p}=.5$ $\rightarrow x=n\hat{p}=40$

In a Sample of 70 males, 40% of them were nursing majors.

$n=70$, $\hat{p}=.4$ $\rightarrow x=28$

Females	Males
$x_1=40$	$x_2=28$
$n_1=80$	$n_2=70$

Pooled Proportion

$$\bar{p}=\frac{x_1+x_2}{n_1+n_2}=\frac{68}{150}\approx .45$$

90% C.I. For the diff. of two Pop. Proportions

2-PropZInt

$$-.03 < P_1 - P_2 < .23$$

$$E=\frac{.23-(-.03)}{2}=.13$$

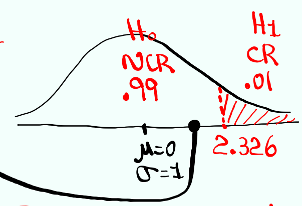
May 13-7:37 PM

Use $\alpha=.01$ to test the claim the prop. of all Females in nursing is greater than the Prop. of all males.

$H_0: P_1 \le P_2$

$H_1: P_1 > P_2$ claim, RTT

CV Z RTT $\alpha=.01$



CTS $Z=1.227$
P-Value $P=.110$

2-PropZTest

$Z=$ invNorm(.99,0,1)

What α value reverses the Conclusion?

P-Value $\le \alpha$

$.110 \le \alpha$

choose $\alpha = .12, .13, .14, \ldots$

CTS is in NCR

P-Value $> \alpha$

H_0 Valid, H_1 invalid

Invalid claim

Reject the claim

May 13-7:44 PM

Chart below shows $\bar{x}$ & s for randomly selected nurses. Assume $\sigma_1 = \sigma_2$

Females	Males
$\bar{x} = 45$	$\bar{x} = 38$
$s = 10$	$s = 12$
$n = 12$	$n = 15$

Pooled: Yes

$df = n_1 + n_2 - 2 = 25$

99% C.I. for $\mu_1 - \mu_2$

2-SampTInt

$$-5 < \mu_1 - \mu_2 < 19$$

$$E = \frac{19 - (-5)}{2} = 12$$

May 13-7:54 PM

Test the claim that there is no difference between two Pop. means.

$H_0: \mu_1 = \mu_2$ Claim

$H_1: \mu_1 \neq \mu_2$ TTT

CV t TTT

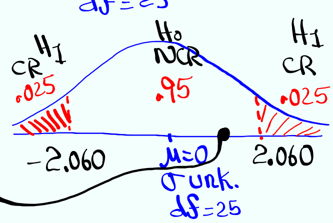
No $\alpha \rightarrow .05$

$df = 25$

CTS $t = 1.619$

P-Value $P = .118$

2-Samp T Test



$t = \text{invT}(.975, 25)$

CTS is in NCR

P-Value > α

H_0 valid, H_1 invalid

Valid claim → FTR the claim

To reverse it

P-Value $\leq \alpha$

$.118 \leq \alpha$ → Choose $\alpha = .12, .13, .14, .20, .30, \ldots$

May 13-8:00 PM

Consider the chart below

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

1) Is $S_1 > S_2$? Yes

2) CTS $F = \frac{S_1^2}{S_2^2} = \frac{10^2}{2^2} = 25$

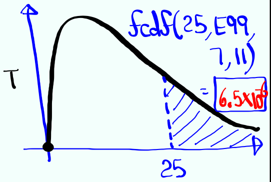
3) $ndf = n_1 - 1 = 7$

$Ddf = n_2 - 1 = 11$

4) Use $\alpha = .02$ to test the claim $\sigma_1 > \sigma_2$.

$H_0: \sigma_1 \leq \sigma_2$

$H_1: \sigma_1 > \sigma_2$ claim, RTT



P-Value $\leq \alpha$

H_0 invalid, H_1 Valid

Valid claim → FTR

choose α from {.01, .05, .10} to reverse the conclusion.

Use 2-SampFTest
CTS F = 25
P-Value $P = 6.5 \times 10^{-6}$

P-Value $> \alpha$

$6.5 \times 10^{-6} > \alpha$

None

May 13-8:10 PM

Exam 1	Exam 2
75 83 90	78 80
70 100	88 100 92
$\bar{x}=84$	$\bar{x}=88$
$S=12$	$S=9$
$n=5$	$n=5$

$S_1 > S_2$ ✓

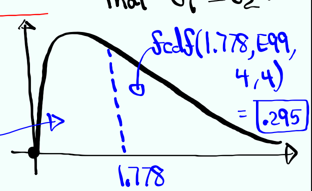
CTS $F = \frac{S_1^2}{S_2^2} = 1.778$

$ndf = 4$, $Ddf = 4$

Test the claim that $\sigma_1 = \sigma_2$.

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT



Fcdf(0, 1.778, 4, 4) = .705

P-Value = 2 · Smaller area
= 2(.295)
= .59

P-Value > α

H_0 Valid, H_1 invalid

Valid claim → FTR

Use 2-SampFTest
CTS F = 1.778
P-Value P = .591

May 13-8:22 PM