Statistics

Lecture 14

Feb 19-8:47 AM

The College [claims] that about 35% of all students use the tutoring services. $P = .35$ ↑ H_0

$n = 425$

I took a [Sample of 425] students and 32% of them had used the tutoring services. $\hat{P} = .32$

Use this sample to [test the claim] (No α → .05)

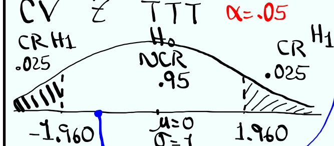
$H_0: P = .35$ claim

$H_1: P \ne .35$ TTT

$x = n\hat{p} = 425(.32) = 136$

if decimal → Round-up

CV Z TTT α = .05



Z = inv Norm (.975, 0, 1)

CTS $Z = -1.297$

P-Value $P = .195$ ✓

1-Prop Z Test

P_0: .35 H_0

$x = 136$

$n = 425$

Prop ≠ P_0 H_1

[Calculate]

CTS is in NCR. H_0 valid

P-Value > α H_1 invalid

→ valid claim → FTR the claim

Dec 6-8:03 AM

Given: $H_0: \mu \le 85$, Claim is H_0,

$n = 25$, $\bar{x} = 88$, $\sigma = 10$, $\alpha = .02$

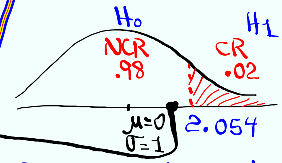
σ Known

Test the claim.

$H_0: \mu \le 85$ claim

$H_1: \mu > 85$ RTT

CV Z RTT $\alpha = .02$



$Z = \text{invNorm}(.98, 0, 1)$

CTS $Z = 1.5$

P-value $P = .067$

Z-Test

inpt: Stats

μ_0: 85 — H_0

σ: 10

$\bar{x} = 88$

$n = 25$

$\mu > \mu_0$ — H_1

Calculate

CTS is in NCR — H_0 Valid

P-value $> \alpha$ ⇒ H_1 invalid

Valid claim → FTR the claim

If we choose α to be .07, .08, .09, .1, ..., then P-value $\le \alpha$

H_0 invalid → Invalid claim

H_1 Valid → Reject the claim

Dec 6-8:22 AM

The College claims that the mean age of all students is at least 28 Yrs. $\mu \ge 28$ (H_0)

$n = 32$

I took a Sample of 32 students, their mean age of 24 Yrs. $\bar{x} = 24$

It is known that Standard deviation of ages of all Students is 7.5 Years $\sigma = 7.5$

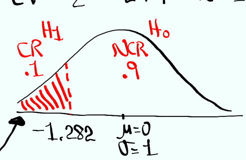
σ Known

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

$H_0: \mu \ge 28$ claim

$H_1: \mu < 28$ LTT

CV Z LTT $\alpha = .1$



CTS $Z = -3.017$

P-value $P = .001$

Z-Test

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

inpt: Stats

μ_0: 28 — H_0

σ: 7.5

$\bar{x}$: 24

n: 32

$\mu < \mu_0$ — H_1

Calculate

CTS is in CR. — H_0 invalid

P-value $\le \alpha$ ⇒ H_1 Valid

→ Invalid claim

Reject the claim

Dec 6-8:35 AM

Given: $H_0: \mu \le 125$, claim is H_1.

$n = 20$, $\bar{x} = 135$, $S = 15$

Test the claim.

σ unknown

CV t RTT No α → .05

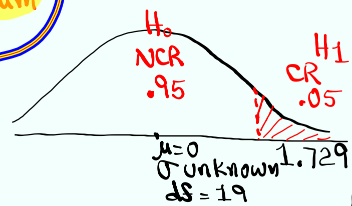
$df = n - 1 = 19$

$H_0: \mu \le 125$

$H_1: \mu > 125$ RTT, claim

CTS $t = 2.981$

P-Value $P = .004$



$t = \text{invT}(.95, 19)$

T-Test

inpt: Stats

μ_0: 125 H_0

$\bar{x} = 135$

$S = 15$

$n = 20$

$\mu > \mu_0$ H_1

Calculate

CTS is in CR
P-value $\le \alpha$ ⇒ H_0 invalid
H_1 valid

Valid claim

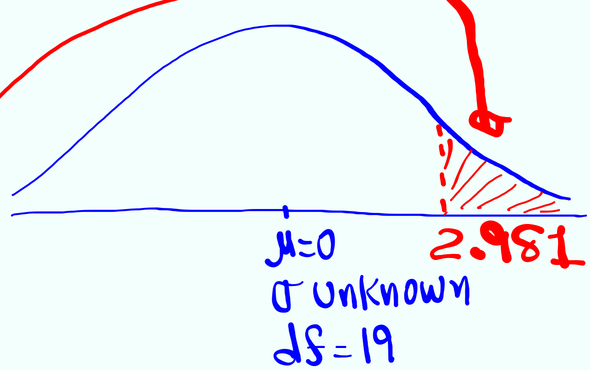
FTR the claim

Dec 6-9:01 AM

CTS $t = 2.981$

RTT $df = 19$

Find P-Value



$\text{tcdf}(2.981, E99, 19) = .004$

Dec 6-9:12 AM

LA Times claims that the mean Salary for all nurses in LA County is $7200/month.

$n=10$ $\mu=7200$ (Ho)

I took a Sample of 10 nurses in LA County and their mean monthly Salary was $7500 with standard deviation of $400. $\bar{x}=7500$ $S=400$

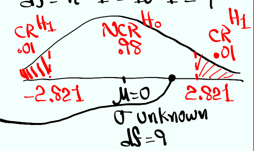
use $\alpha=.02$ to test the claim. σ unknown

$H_0: \mu=7200$ claim

$H_1: \mu\neq 7200$ TTT

CV t TTT $\alpha=.02$

$df=n-1=10-1=9$



CTS $t=2.372$

P-value $P=.042$

T-Test

Inpt: Stats

μ_0:7200 Ho

$\bar{x}=7500$

$S=400$

$n=10$

$\mu\neq\mu_0$ H_1

$t=\text{invT}(.99,9)$

CTS is in NCR ⇒ Ho Valid, H_1 invalid → valid claim, FTR the claim

P-value > α

If we choose α to be .05, .06, .07, .08, .09, .1, ...

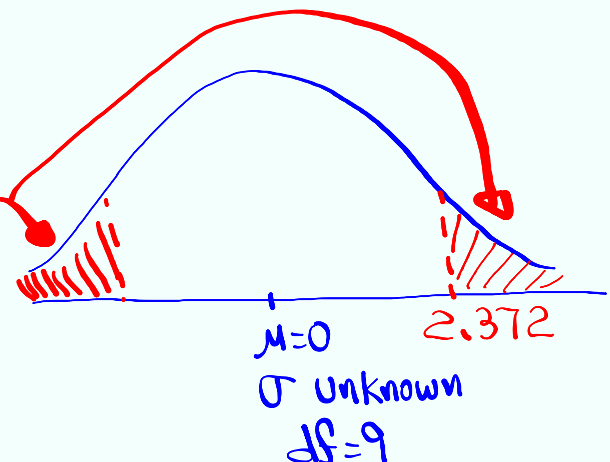
P-value ≤ α → Ho invalid, H_1 valid → Invalid claim Reject it.

Dec 6-9:15 AM

CTS $t=2.372$

TTT $df=9$

Find P-Value



$2\cdot\text{tcdf}(2.372, E99, 9) = .042$

Dec 6-9:30 AM

I randomly selected 12 exams. Here are the scores:

84	65	100	92
95	70	75	78
88	80	100	68

Find
1) $\bar{x} = 83$
2) $S = 12$
3) $n = 12$ → $df = 12-1 = 11$

Round to whole #

NO α → use .05

Test the claim that the mean of all exams is at least 85

$\mu \geq 85$ ← H_0

$H_0: \mu \geq 85$ claim

$H_1: \mu < 85$ LTT

CTS $t = -.578$

P-value $P = .288$

T-Test

inpt: Stats

$\mu_0: 85$ H_0

$\bar{x} = 83$

$S = 12$

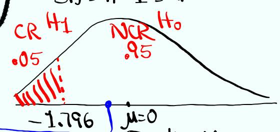
$n = 12$

$\mu < \mu_0$ H_1

σ unknown

CV t LTT $\alpha = .05$

$df = n-1 = 11$



σ unknown

$df = 11$

$t = \text{invT}(.05, 11)$

CTS is in NCR
P-value > α
⇒ H_0 Valid
H_1 invalid
↳ Valid claim
FTR the claim

Dec 6-9:33 AM

SG 27

Testing one population standard deviation:

$H_0: \sigma = \sigma_0$	$H_0: \sigma \geq \sigma_0$	$H_0: \sigma \leq \sigma_0$
$H_1: \sigma \neq \sigma_0$	$H_1: \sigma < \sigma_0$	$H_1: \sigma > \sigma_0$
TTT	LTT	RTT

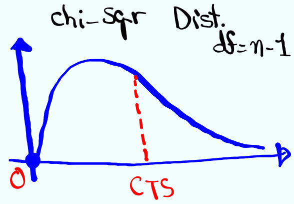
P-Value Method only:

CTS $\chi^2 = \frac{(n-1) \cdot S^2}{\sigma^2}$

chi-square

chi-sqr Dist.

$df = n-1$



P-value > α H_0 valid, H_1 invalid

P-Value ≤ α H_0 invalid, H_1 valid

RTT $\chi^2\text{cdf}(\text{CTS}, \text{E99}, df)$

LTT $\chi^2\text{cdf}(0, \text{CTS}, df)$

TTT Find both areas, multiply the smaller area by 2.

Final Conclusion must be about the claim.

Dec 6-10:05 AM

Given $H_0: \sigma \le 10$, claim is H_0, $\alpha = .02$

$n = 8$, $S = 12$.

Test the claim.

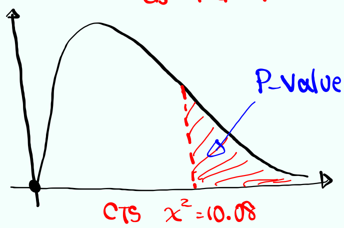
$H_0: \sigma \le 10$ claim

$H_1: \sigma > 10$ RTT

CTS

$$\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(8-1)\cdot 12^2}{10^2} = \boxed{10.08}$$

P_Value $df = n-1 = 7$



P_value $= \chi^2 cdf(10.08, E99, 7)$

$= \boxed{.184}$

P_value $> \alpha$
$.184$ $.02$

H_0 Valid → valid claim

H_1 Invalid

FTR the claim

Dec 6-10:13 AM

The department claims that standard deviation of all math scores is below 8. $\sigma < 8$ ← H_1

I took a sample of 10 exams, standard deviation of their scores was 5.

$n = 10$, $S = 5$

Test the claim at $\alpha = .1$

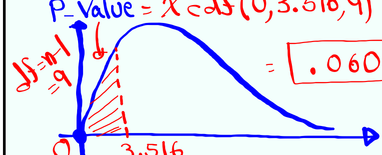
$H_0: \sigma \ge 8$

$H_1: \sigma < 8$ claim, LTT

CTS

$$\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(10-1)\cdot 5^2}{8^2} = \boxed{3.516}$$

P_Value $= \chi^2 cdf(0, 3.516, 9) = \boxed{.060}$



P_Value $< \alpha$
$.060$ $.1$

H_0 invalid

H_1 valid

valid claim

FTR the claim

If we choose α to be $.05, .04, .03, .02, .01$

P_Value $> \alpha$ → H_0 valid
H_1 invalid
we reject the claim

Dec 6-10:21 AM

I randomly selected 8 college students.
Here are their ages:

24 18 32 30
19 25 25 28

Find
1) $\bar{x} = 25$
2) $S = 5$
3) $n = 8$
} Round to whole #

No α → .05

The college [claims] that [standard deviation] of ages of [all] students [is 4 Yrs.]

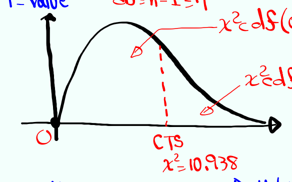
$\sigma = 4$

$H_0: \sigma = 4$ claim
$H_1: \sigma \neq 4$ TTT

CTS $\chi^2 = \frac{(n-1)S^2}{\sigma^2} = \frac{(8-1)\cdot 5^2}{4^2}$

$\chi^2 = 10.938$

P-Value $df = n-1 = 7$



$\chi^2 cdf(0, 10.938, 7) = .859$

$\chi^2 cdf(10.938, E99, 7) = .141$

Since it is a TTT ⇒ P-Value = 2 · Smaller one
$= 2(.141)$
$= .282$

P-Value > α
.282 .05

H_0 valid
H_1 invalid
→ Valid claim → FTR the claim

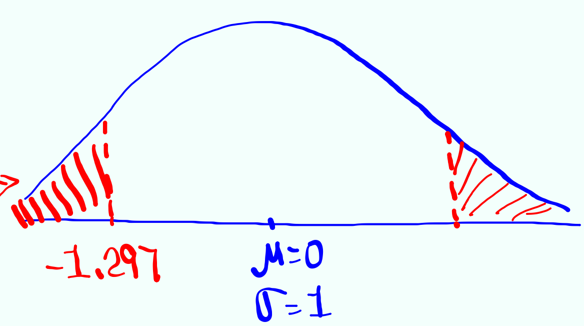
SG 27 ✓

Dec 6-10:32 AM

Given CTS $Z = -1.297$

TTT

Find the P-Value.



Twice that area.

P-value $= 2 * normalcdf(-E99, -1.297, 0, 1)$

$= .195$

Dec 6-8:17 AM