Statistics
Lecture 28

Feb 19-8:47 AM

LA Times claim that 70% of LA residents expect more from government in regard to homeless issue in Los Angeles.

$P = .7$ claim

H_0

In a survey of 875 LA residents, 80% of them felt the same.

$n = 875$, $\hat{P} = .8$

$x = n\hat{P} = 875(.8) = 700$

If decimal → Round-up

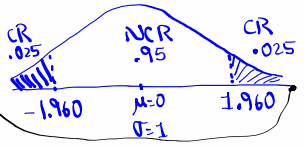
No α → use .05

Test the claim.

CV Z TTT $\alpha = .05$

H_0: $P = .7$ claim

H_1: $P \neq .7$ TTT



CTS $Z = 6.455$

P-value $P = 1.088 \times 10^{-10}$

1-Prop ZTest

$P_0 = .7$

$x = 700$

$n = 875$

Prop $\neq P_0$

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

CTS is in CR ⇒ P-value $\leq \alpha$

H_0 invalid → Invalid claim

H_1 valid

Reject the claim

Dec 11-7:21 AM

LA Times claim that the mean age of all teachers in LAUSD is more than 50 yrs old.

μ $>$ 50 claim

H_1

In a sample of 32 teachers from LAUSD, their mean age was 52.5 yrs.

$n=32$, $\bar{x}=52.5$

It is known that standard deviation of ages of all teachers in LAUSD is 7.5 yrs.

$\sigma=7.5$

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

H_0: $\mu \leq 50$

H_1: $\mu > 50$ claim, RTT

σ Known

CV z RTT $\alpha=.1$

CTS z: 1.886

P-value P: .030

z-Test

inpt: STATS

μ_0: 50

σ: 7.5

$\bar{x}$: 52.5

n: 32

$\mu > \mu_0$

z=invNorm(.9,0,1)

CTS is in CR $\Rightarrow$ H_0 invalid

P-value $\leq \alpha$ $\Rightarrow$ H_1 valid

Valid claim

FTR the claim

If we choose α to be .02 or .01 then P-value $> \alpha$ therefore

H_0 valid and H_1 invalid $\Rightarrow$ Reject the claim

Dec 11-7:33 AM

LA Times claim that the mean score of all math exams in LAUSD 6th grade classes is below 75.

claim $\mu < 75$

H_1

In a sample of 20 exams from LAUSD 6th grade classes, the mean score was 74 with standard deviation of 8.

$n=20$, $\bar{x}=74$, $S=8$

Use $\alpha=.02$ to test the claim.

H_0: $\mu \geq 75$

H_1: $\mu < 75$ claim, LTT

σ Unknown

CV t LTT $\alpha=.02$

$df=n-1=19$

CTS t: -.559

P-value P: .291

T-Test

inpt: Stats

μ_0: 75

$\bar{x}$: 74

S: 8

n: 20

$\mu < \mu_0$

t=invT(.02, 19)

CTS is in NCR $\Rightarrow$ H_0 valid

P-value $> \alpha$ $\Rightarrow$ H_1 invalid

Invalid claim

Reject the claim

If we change α to .3, then

P-value $\leq \alpha$ $\Rightarrow$ H_0 invalid, H_1 valid $\Rightarrow$ FTR the claim

Dec 11-7:49 AM

LA Times claim that standard deviation of Salaries of all teachers in LAUSD is $400.

$\sigma = 400$ claim

H_0

I took a sample of 10 teachers, their mean Salary was $7500/month with standard dev. of $500.

$n = 10$ $\bar{x} = 7500$ $s = 500$

No $\alpha \rightarrow \alpha = .05$

Test the claim.

P-value method

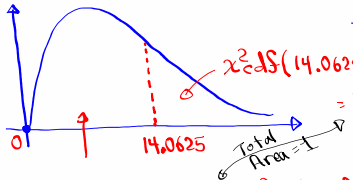
$H_0: \sigma = 400$ claim

$H_1: \sigma \neq 400$ TTT

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

$= \frac{(10-1)\cdot 500^2}{400^2}$

$= 14.0625$



$\chi^2cdf(14.0625, E99, 9)$

$= .120$

Total Area = 1

$\chi^2cdf(0, 14.0625, 9) = .880$

P-value = 2 · Smaller area

$= 2 \cdot (.120)$

$= .240$

P-value > α

.240 > .05

H_0 valid

H_1 invalid

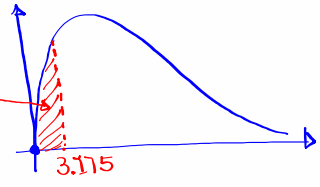
valid claim

FTR the claim

Dec 11-8:03 AM

CTS $\chi^2 = 3.175$, LTT, $df = 8$, find P-value

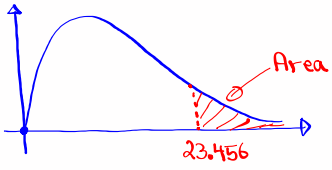
P-value = Area



$= \chi^2cdf(0, 3.175, 8)$

$= .077$

CTS $\chi^2 = 23.456$, $df = 10$, RTT, find P-value.



Area = P-value

$= \chi^2cdf(23.456, E99, 10)$

$= .009$

SG 25-27 ✓

Dec 11-8:19 AM

SG 31

Comparing Two Population Standard Deviations:

$H_0: \sigma_1 = \sigma_2$ $H_1: \sigma_1 \neq \sigma_2$ TTT

$H_0: \sigma_1 \geq \sigma_2$ $H_1: \sigma_1 < \sigma_2$ LTT

$H_0: \sigma_1 \leq \sigma_2$ $H_1: \sigma_1 > \sigma_2$ RTT

Sample 1	Sample 2
$n_1 =$	$n_2 =$
$S_1 =$	$S_2 =$

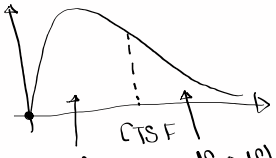
$S_1 > S_2$

$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

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

CTS F, P-value $\Rightarrow$ 2-SampFTest



fcdf(L, U, Ndf, Ddf)

P-value = 2 · Smaller area

P-value $> \alpha$ H_0 valid, H_1 invalid

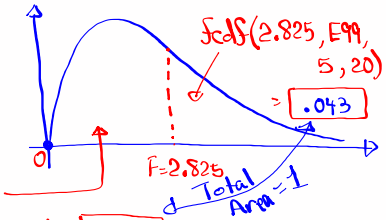
P-value $\leq \alpha$ H_0 invalid H_1 valid

Final Conclusion must be about the claim

Dec 11-8:45 AM

CTS $F = 2.825$ $Ndf = 5$, $Ddf = 20$, TTT

Find P-value.



fcdf(0, 2.825, 5, 20) = .957

P-value = 2 · Smaller Area

= 2(.043) = .086

Dec 11-8:53 AM

Consider the chart below

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 12$
$S_1 = 10$	$S_2 = 5$

1) Verify that $S_1 > S_2$. ✓

2) $NdF = n_1 - 1 = 8 - 1 = 7$

$DdF = n_2 - 1 = 12 - 1 = 11$

3) CTS $F = \frac{S_1^2}{S_2^2} = \frac{10^2}{5^2} = \boxed{4}$ ✓

4) use $\boxed{\alpha = .1}$ to test the claim that $\sigma_1 \neq \sigma_2$.

$H_0: \sigma_1 = \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ claim, TTT $\Rightarrow$ CTS $F = 4$ ✓, P-value $P = .041$ ✓ H_1

2-SampFTest

input: STATS

$S_1 = 10$

$n_1 = 8$

$S_2 = 5$

$n_2 = 12$

$\sigma_1 \neq \sigma_2$ H_1

P-value $\leq \alpha$

$.041 \quad .1$

H_0 invalid

H_1 valid $\rightarrow$ Valid claim

FTR the claim

If we choose α to be $.03, .02, .01$, then P-value $> \alpha$

H_0 valid

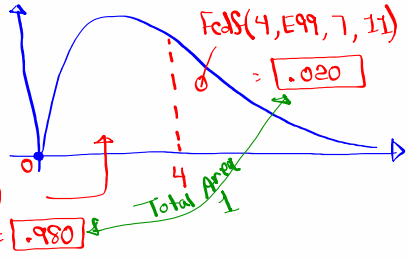
H_1 invalid $\rightarrow$ Invalid claim

Reject the claim.

Dec 11-8:58 AM

CTS $F = 4$, $NdF = 7$, $DdF = 11$, TTT

Find P-value.



P-value = 2 · Smaller area = 2(.020)

= .040

Dec 11-9:10 AM

10 Female students had a mean age of 23.5 yrs with standard deviation of 5.5 yrs.

10 male students had a mean age of 27.8 yrs with standard deviation of 8.5 yrs.

Males Sample 1	Females Sample 2
$n_1 = 10$	$n_2 = 10$
$S_1 = 8.5$	$S_2 = 5.5$

$S_1 > S_2$

$ndf = n_1 - 1 = 9$

$Ddf = n_2 - 1 = 9$

CTS $F = \frac{S_1^2}{S_2^2} = \frac{8.5^2}{5.5^2} \approx 2.388$

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

No α → use .05

H_0

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS F = 2.388

P-value P = .211

2-SampFTest

P-value > α

.211 > .05

H_0 valid → valid claim → FTR the claim

H_1 invalid

If we choose $\alpha = .25$

P-value $\leq \alpha$ → H_0 invalid → Invalid claim → Reject the claim

Dec 11-9:14 AM

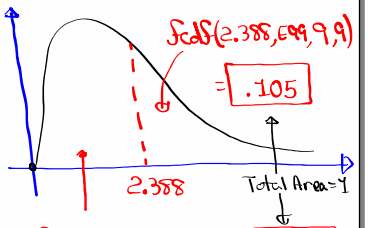
CTS F = 2.388

ndf = 9

Ddf = 9

TTT

Find P-value.



fcdf(0, 2.388, 9, 9) = .895

P-value = 2 · Smaller area = 2(.105) = .210

Dec 11-9:27 AM

Exams randomly Selected from two classes:

Morning	Evening
72 75 80	82 70 55
90 100 85	95 100
Round to 1-decimal: $\bar{x}=83.7$, $s=10.3$, $n=6$	Round to 1-decimal: $\bar{x}=80.4$, $s=18.4$, $n=5$

Evening	Morning
$n_1=5$	$n_2=6$
$s_1=18.4$	$s_2=10.3$

$s_1 > s_2$

Use $\alpha=.01$ to test the claim that $\sigma_1 > \sigma_2$.

$H_0: \sigma_1 \leq \sigma_2$

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

2-Samp F Test

CTS $F=3.191$

P-Value $P=.118$ ✓

P-value $>$ α
.118 .01

H_0 valid, H_1 invalid

Invalid claim

Reject the claim

change α to .12 → FTR the claim

P-Value $\leq \alpha \rightarrow H_1$ Valid

Dec 11-9:32 AM

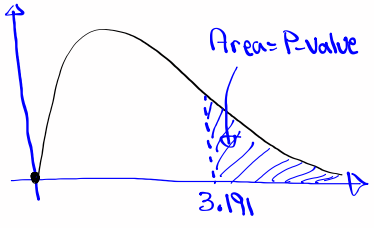
CTS $F=3.191$

Ndf=4

Ddf=5

RTT

Find P-value.



P-value = Fcdf(3.191, E99, 4, 5)

= .118

SG 31

Dec 11-9:43 AM