Statistics

Lecture 26

Feb 19-8:47 AM

The College $\boxed{\text{claims}}$ that $\boxed{\text{at most } 30\%}$ of all students are in favor of online classes. ($P \le .3$)

I took a $\boxed{\text{Survey of 150}}$ students and $\boxed{34\% \text{ of them}}$ were in favor of online classes. ($n = 150$, $\hat{p}$)

Test the claim.

$n = 150 \quad \hat{p} = .34$

$x = n\hat{p} = 150(.34) = 51$

$H_0: P \le .3$ claim

$H_1: P > .3$ RTT

CV Z No $\alpha \to \alpha = .05$

$\boxed{\text{CTS } Z = 1.069}$

$\boxed{\text{P-value } P = .143}$

1-Prop Z Test

$P_0 = .3$ H_0

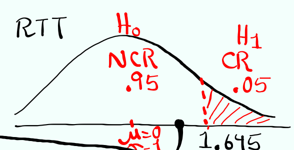
$x = 51$

$n = 150$

Prop $> P_0$ H_1

Calculate

RTT



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

CTS is in NCR $\Rightarrow$ H_0 Valid

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

Valid claim

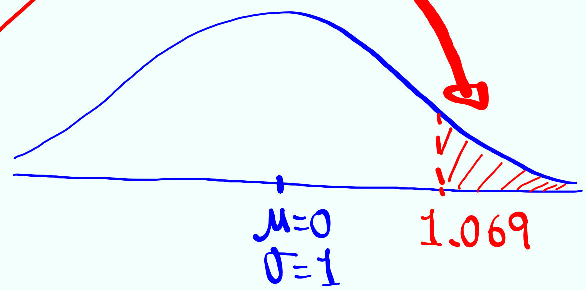
FTR the claim

Dec 2-12:17 PM

CTS $Z = 1.069$

RTT

find $\boxed{\text{P-value}}$



$\text{normalcdf}(1.069, E99, 0, 1) = \boxed{.143}$

If it was TTT $\Rightarrow$ P-value $= 2(.143) = \boxed{.286}$

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$\mu < 500$

The college claims the mean weekly income for all students is below \$500.

$n = 24$

I took a Sample of 24 Students, their mean weekly income was \$475 with standard deviation of \$80. $n = 24$ $\bar{x} = 475$ $S = 80$

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

$H_0: \mu \geq 500$

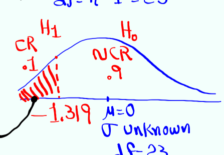
$H_1: \mu < 500$ claim, LTT

CV t $\alpha = .1$, LTT

$df = n - 1 = 23$

CTS $t = -1.531$

P-value $P = .070$



$t = \text{invT}(.1, 23)$

T-Test

inpt: STATS

$\mu_0 = 500$ H_0

$\bar{x} = 475$

$S = 80$

$n = 24$

$\mu < \mu_0$ H_1

CTS is in CR

P-value $\leq \alpha$ $\Rightarrow$ H_0 invalid

H_1 valid

Valid claim

FTR the claim.

If we choose $\alpha = .06, .05, .04, .03, .02$, or $.01$

P-value $> \alpha$ $\Rightarrow$ H_0 valid

.070

H_1 invalid $\rightarrow$ Reject the claim

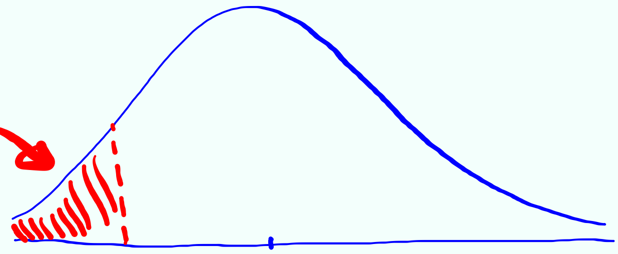
Dec 2-12:32 PM

CTS $t = -1.531$

$df = 23$

LTT

Find $\boxed{\text{P\_Value}}$ → $tcdf(-E99, -1.531, 23) = \boxed{.070}$



If it was TTT ⟹ P_Value $= 2(.070) = \boxed{.140}$

Dec 2-12:48 PM

The College claims that the standard deviation of ages of all students is not 8 Years. $\sigma \neq 8$

$n = 12$

I took a Sample of 12 Students, Standard deviation of their ages was 10. $S = 10$

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

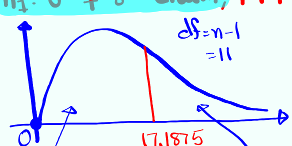
$H_0: \sigma = 8$

P-Value Method

$H_1: \sigma \neq 8$ claim, TTT

CTS

$$\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(12-1)\cdot 10^2}{8^2} = \boxed{17.1875}$$



$\chi^2cdf(0, 17.1875, 11) = \boxed{.898}$

$\chi^2cdf(17.1875, E99, 11) = \boxed{.102}$

because it is TTT P-value $= 2 \cdot$ Smaller $= 2(.102) = \boxed{.204}$

P-value > α
.204 .02

H_0 Valid

H_1 Invalid → Invalid claim

Reject the claim

Dec 2-12:52 PM

AAA claims standard deviation of all gas prices is at most $.25 $\sigma \le .25$

$n = 10$

I took a sample of 10 gas stations and standard deviation of gas prices was $.30. $S = .3$

No $\alpha \rightarrow .05$

Test the claim.

P-value Method

$H_0: \sigma \le .25$ claim

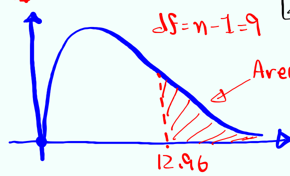
$H_1: \sigma > .25$ RTT

CTS

$$\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(10-1)\cdot(.3)^2}{(.25)^2}$$

$\boxed{\chi^2 = 12.96}$

$df = n-1 = 9$



Area = P-value $= \chi^2cdf(12.96, E99, 9)$

$= \boxed{.164}$

P-value $>$ α

.164 .05

H_0 valid

H_1 invalid

valid claim

FTR the claim

SG 24-27

Dec 2-1:06 PM

SG 31

Compare two Population Standard deviations:

$H_0: \sigma_1 = \sigma_2$	$H_0: \sigma_1 \ge \sigma_2$	$H_0: \sigma_1 \le \sigma_2$
$H_1: \sigma_1 \ne \sigma_2$	$H_1: \sigma_1 < \sigma_2$	$H_1: \sigma_1 > \sigma_2$
TTT	LTT	RTT

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

CTS F

P-Value P

Always make a chart

2-SampFTest

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

$S_1 > S_2$

Proceed with testing chart

Draw final conclusion about the claim.

F-Dist has two df:

$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

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Consider the chart below

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

1) Verify $S_1 > S_2$ ✓

2) $Ndf = n_1 - 1 = 7$
$Ddf = n_2 - 1 = 11$

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

4) Test the claim that $\sigma_1 = \sigma_2$ using $\alpha = .05$.

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS $F=4$

P-value $P = .041$ ✓

2-Samp F Test
Inpt: Stats
$s_1=10$
$n_1=8$
$S_2=5$
$n_2=12$
$\sigma_1 \neq \sigma_2$
Calculate

P-value $\leq \alpha$
$.041 \quad .05$

H_0 invalid
H_1 Valid
Reject the claim

If we change $\alpha = .06, .07, .08, .09, .10, \ldots$

P-value $\leq \alpha$ → No change

But If we change $\alpha = .04, .03, .02, .01$

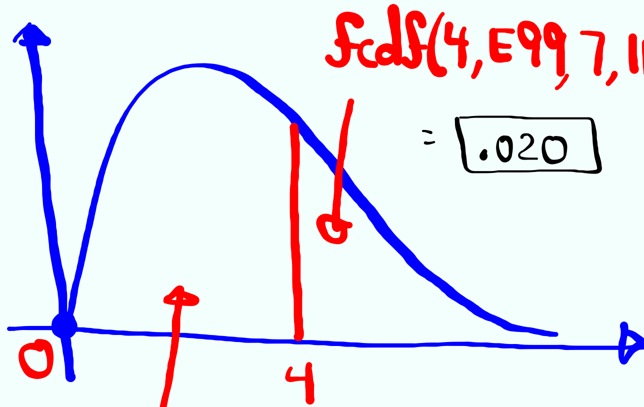
P-value $> \alpha$

H_0 Valid → Valid claim
H_1 invalid

FTR the claim

Dec 2-1:44 PM

CTS $F=4$
$Ndf=7$
$Ddf=11$
TTT
Find P-value.



fcdf(4, E99, 7, 11) = $\boxed{.020}$

fcdf(0, 4, 7, 11) = $\boxed{.980}$

P-value = 2 · Smaller one
$= 2(.020) = \boxed{.040}$

Dec 2-1:54 PM

Consider the chart below

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

1) Verify $S_1 > S_2$ ✓

2) $Ndf = n_1 - 1 = 7$

$Ddf = n_2 - 1 = 7$

3) CTS $F = \dfrac{S_1^2}{S_2^2} = \dfrac{10^2}{8^2} = 1.5625$

4) Test the claim that $\sigma_1 \geq \sigma_2$. No α → .05

$H_0: \sigma_1 \geq \sigma_2$ claim

$H_1: \sigma_1 < \sigma_2$ LTT

$\boxed{\text{CTS } F=1.5625 \quad \text{P-value } P=.715}$ ✓

2-SampFTest

inpt: $\boxed{\text{stats}}$

$S_1=10$

$n_1=8$

$S_2=8$

$n_2=8$

$\sigma_1 < \sigma_2$ H_1

P-value > α

.715 .05

H_0 valid → $\underbrace{\text{Valid claim}}$

H_1 invalid

FTR the claim

Dec 2-1:58 PM

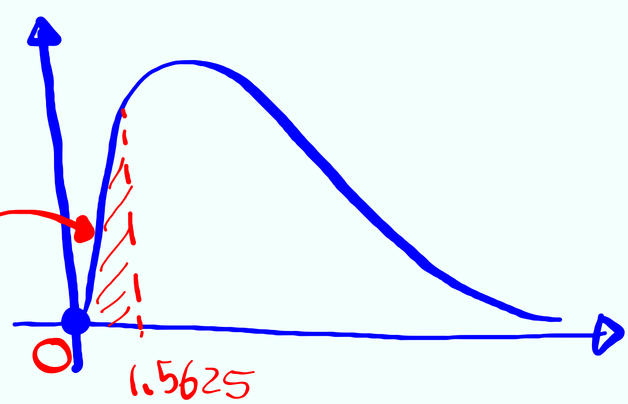
CTS $F = 1.5625$

$Ndf = 7$

$Ddf = 7$

LTT

Find $\boxed{\text{P-value}}$



→ fcdf(0, 1.5625, 7, 7)

$= \boxed{.715}$

Dec 2-2:07 PM

I randomly selected 10 female students, standard dev. of their ages was 8 yrs.

I randomly selected 12 male students, standard dev. of their ages was 5 yrs

Females	Males
$n_1 = 10$	$n_2 = 12$
$S_1 = 8$	$S_2 = 5$

1) Verify $S_1 > S_2$ ✓

2) $Ndf = n_1 - 1 = 9$

$Ddf = n_2 - 1 = 11$

3) CTS $F = \frac{S_1^2}{S_2^2} = \frac{8^2}{5^2} = 2.56$ ✓

4) Use $\alpha = .1$ to test the claim that there is a difference between two pop. standard deviations.

$H_0: \sigma_1 = \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ claim, TTT

$\boxed{\begin{array}{l} \text{CTS } F = 2.56 \\ \text{P-Value } P = .144 \end{array}}$

2-Samp F Test

P-Value $>$ α → H_0 valid

.144 $\quad$ .1

H_1 invalid → Invalid claim

Reject the claim

If we change $\alpha = .15$

P-Value $\leq \alpha$ → H_0 invalid

.144 $\quad$ .15

H_1 valid → Valid claim → FTR the claim

Dec 2-2:09 PM

Daily class exams			MW class exams		
72	85	100	100	94	68
90	95	80	50	80	75

$\bar{x} = 87$ $\quad$ $\bar{x} = 78$

$S = 10$ $\quad$ $S = 18$

$n = 6$ $\quad$ $n = 6$

Round to whole #

Test the claim that there is no difference between two population standard deviations.

MW	Daily
$n_1 = 6$	$n_2 = 6$
$S_1 = 18$	$S_2 = 10$

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

$\boxed{\begin{array}{l} \text{CTS } F = 3.24 \\ \text{P-Value } P = .223 \end{array}}$

2-Samp F Test

P-Value $>$ α

.223 $\quad$ .05

H_0 Valid → Valid claim

H_1 invalid

FTR the claim

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