Statistics

Lecture 22

Feb 19-8:47 AM

In a Survey of 400 voters, 45% of them were in favor of mail-in ballots. $n=400$, $\hat{P}=.45$ → $x=n\hat{P}=400(.45)=180$

CNN claims that 40% of all voters are in favor of mail-in ballots. $P=.4$ ← H_0

Test the claim at $\alpha=.02$.

$H_0: P=.4$ claim

$H_1: P\neq .4$ TTT

CV Z TTT $\alpha=.02$

H_1 CR .01 | H_0 NCR .98 | H_1 CR .01

-2.054 | $\mu=0$, $\sigma=1$ | 2.054

CTS $Z=2.041$

P-Value $P=.041$

$Z_{.01}=\text{invNorm}(.98,0,1)=2.054$

1-PropZTest

$P_0: .4$

$x: 180$

$n: 400$

Prop $\neq P_0$

CTS is in NCR → H_0 valid

P-Value $>\alpha$ ⇒ H_1 invalid

Valid claim

FTR the claim

what α values reverses the Conclusion?

P-value $\leq \alpha$

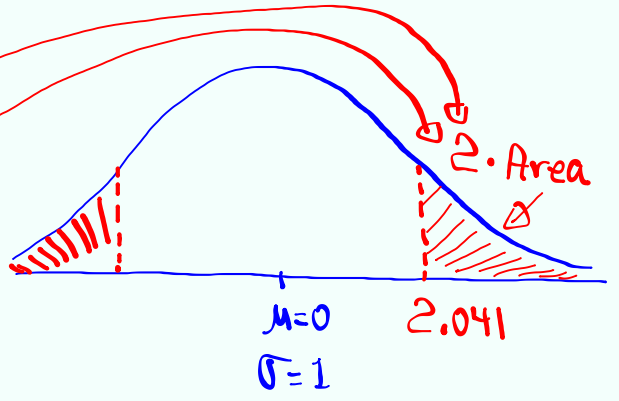
$.041 \leq \alpha$ → choose .05, .06, .01, ...

May 20-1:52 PM

CTS $Z = 2.041$

TTT

Find P-Value



$$\text{P-Value} = 2 \cdot \text{normalcdf}(2.041, E99, 0, 1)$$

$$\approx \boxed{.041}$$

May 20-2:06 PM

CNN claims that the mean age of all voters is at most 48 Yrs. $\mu \leq 48$ ← H_0

I randomly Selected 40 voters and their mean age was 50. $n = 40$ $\bar{x} = 50$

It is known that standard deviation of ages of all voters is 8 Yrs. $\sigma = 8$

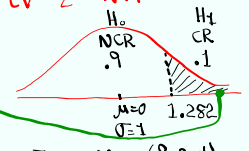
Test the claim at $\alpha = .1$.

$H_0: \mu \leq 48$ claim

$H_1: \mu > 48$ RTT

σ Known

CV z RTT $\alpha = .1$



CTS $z = 1.581$

P-Value $P = .057$

Z-Test

Inpt:
$\mu_0 = 48$
$\sigma = 8$
$\bar{x} = 50$
$n = 40$
$\mu > \mu_0$

Stats

$z_{.1} = \text{invNorm}(.9, 0, 1)$

CTS is in CR → H_0 invalid, H_1 Valid

P-value $\leq \alpha$

Invalid claim

Reject the claim.

what α values reverses the result?

P-value $> \alpha$

$.057 > \alpha$

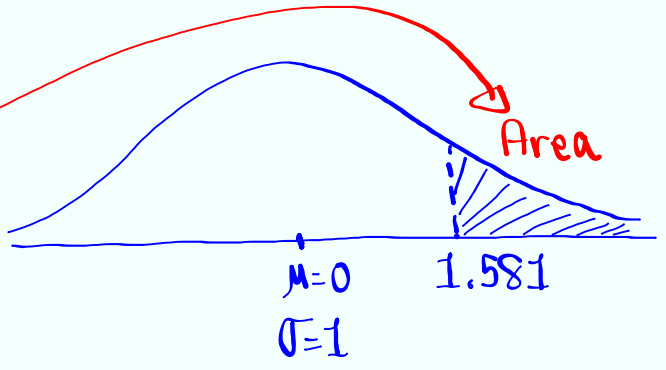
Choose α to be .05, .04, .03, .02, .01

May 20-2:09 PM

CTS $Z = 1.581$

RTT

Find p-value.



P-Value = normalcdf(1.581, E99, 0, 1) ≈ .057

May 20-2:25 PM

CNN claims the mean wait time to cast your vote in person is at least 45 minutes.

$\mu \geq 45$ H_0

I randomly selected 10 voters, their mean wait time at voting location was 35 minutes with standard dev. of 12 minutes. $n=10$, $\bar{x}=35$, $s=12$

Test the claim. NO α

$H_0: \mu \geq 45$ claim

$H_1: \mu < 45$ LTT

σ unknown

CV t LTT $\alpha = .05$

$df = n-1 = 9$

CTS $t = -2.635$

P-Value $P = .014$

CR .05 NCR .95

-1.833 μ=0 σ unknown df=9

T-Test

inpt: STATS

$\mu_0 = 45$

$\bar{x} = 35$

$s = 12$

$n = 10$

$\mu < \mu_0$

t=invT(.05,9)

CTS is in CR ⇒ H_0 invalid

P-value ≤ α

H_1 valid

Invalid claim

Reject the claim

Suggest a value for α that reverses this Conclusion?

we want P-Value > α

.014 > α → choose α = .01

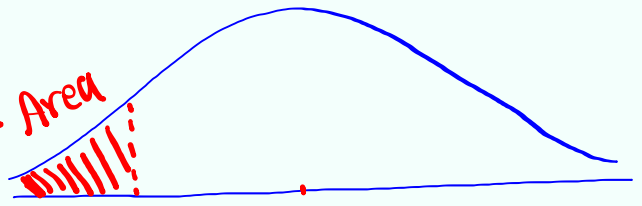
May 20-2:28 PM

CTS $t = -2.635$

$df = 9$

LTT

find p-Value.



σ unknown

$df = 9$

P-Value = tcdf(-E99, -2.635, 9)

= .014

May 20-2:45 PM

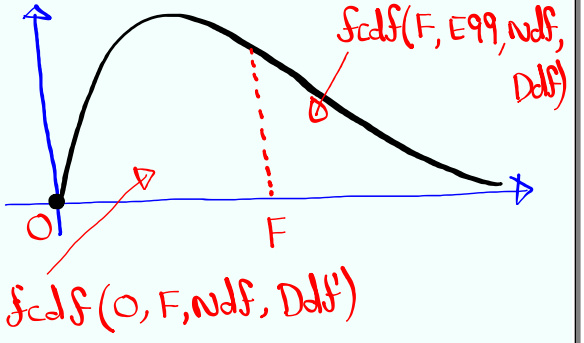
F - Dist.

1) Graph begins at 0 and it is positively Skewed.

2) Total area under the curve is 1.

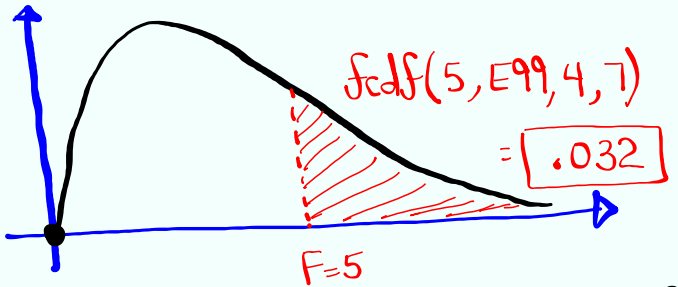
3) It is not Symmetric.

4) It comes with two degrees of freedom: Ndf & Ddf



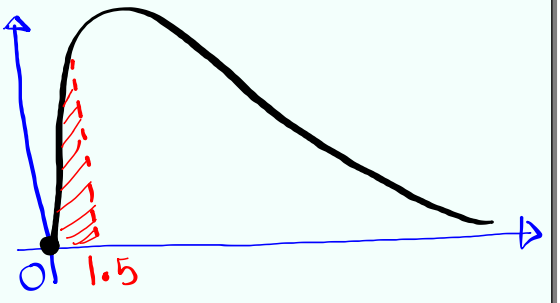
May 20-3:03 PM

Find P(F>5) with Ndf=4 & Ddf=7.



Find P(F<1.5) with Ndf=6 & Ddf=10

fcdf(0,1.5,6,10)
=.728

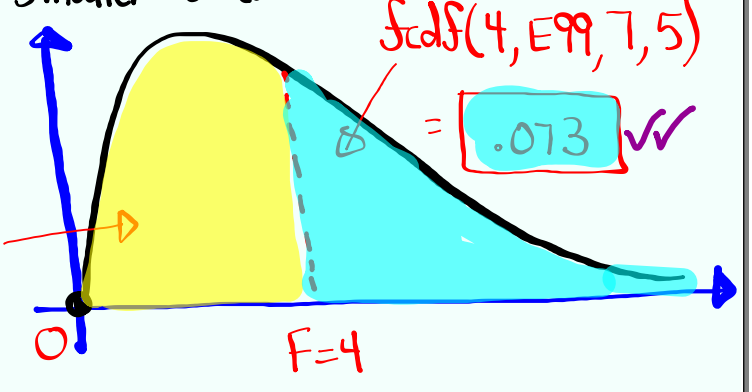


May 20-3:07 PM

Find the area on each side of F=4 with Ndf=7 & Ddf=5.

Multiply the Smaller area by 2.

fcdf(0,4,7,5)
=.927 ✓



2 · Smaller area = 2(.073) = .146

May 20-3:12 PM

Comparing two Population Standard deviations:

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

$S_1 > S_2$

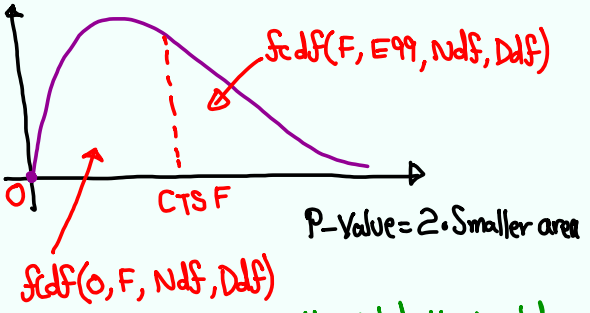
$H_0: \sigma_1 = \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ TTT

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

$Ndf = n_1 - 1$, $Ddf = n_2 - 1$

To find the P-Value



P-Value = 2 · Smaller area

fcdf(0, F, Ndf, Ddf)

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

P-Value $\leq \alpha$ H_0 invalid, H_1 valid

May 20-3:17 PM

Use the chart below to test the claim that $\sigma_1 = \sigma_2$ with $\alpha = .02$.

Group 1	Group 2
$n_1 = 6$	$n_2 = 10$
$S_1 = 8$	$S_2 = 4$

1) verify $S_1 > S_2$ ✓

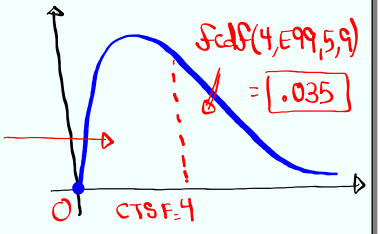
2) CTS $F = \frac{S_1^2}{S_2^2} = \frac{8^2}{4^2} = 4$

3) $Ndf = 6 - 1 = 5$
$Ddf = 10 - 1 = 9$

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

fcdf(0, 4, 5, 9) = .965



P-Value = 2 · Smaller area
= 2 · (.035) = .07

P-Value $>$ α
.07 .02

H_0 Valid
H_1 invalid
valid claim
FTR

STAT TESTS 2-SampFTest
CTS F = 4
P-Value P = .069

May 20-3:24 PM

8 Female Students: Stand. dev. of their ages was 8.

10 Male Students: " " " " " 5.

Females	Males
$n_1=8$	$n_2=10$
$s_1=8$	$s_2=5$

no $\alpha \rightarrow .05$

1) $s_1 > s_2$ ✓

2) CTS $F = \frac{s_1^2}{s_2^2} = \frac{8^2}{5^2} = 2.56$

3) Ndf=7, Ddf=9

Test the claim that there is a difference between σ_1 & σ_2.

$H_0: \sigma_1 = \sigma_2$

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

2-SampF Test

CTS F = 2.56

P-Value P = .190 ✓

P-Value $> \alpha$

H_0 Valid

H_1 invalid Invalid claim

Reject the claim

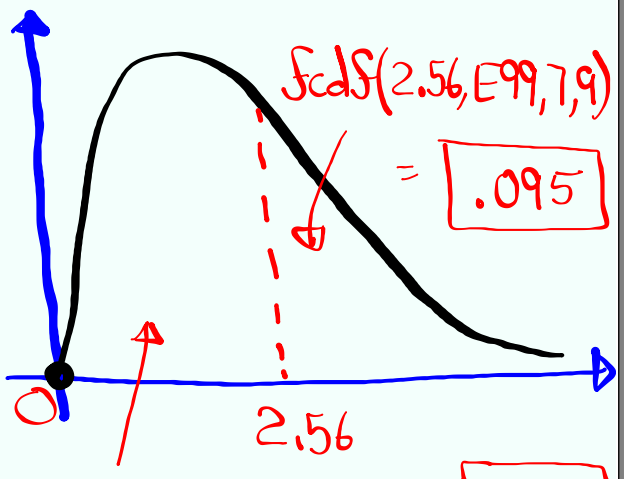
May 20-3:34 PM

CTS F = 2.56

TTT

Ndf=7, Ddf=9

Find P-Value.



fcdf(0, 2.56, 7, 9) = .905

P-Value = 2 · Smaller area

= 2(.095) = .190

May 20-3:43 PM

Use the chart below to test the claim that $\sigma_1 > \sigma_2$.

$H_0: \sigma_1 \leq \sigma_2$ $\alpha = .05$

$H_1: \sigma_1 > \sigma_2$ claim RTT

Use 2-SampFTest

Group 1	Group 2
$n_1 = 5$	$n_2 = 8$
$S_1 = 10$	$S_2 = 4$

CTS $F = 6.25$

P-Value $P = .018$

P-Value $\leq \alpha$

H_0 invalid, H_1 valid

valid claim → FTR

Give two values for α to reverse the Conclusion.

P-Value $> \alpha$

$.018 > \alpha$

choose .01, or .001

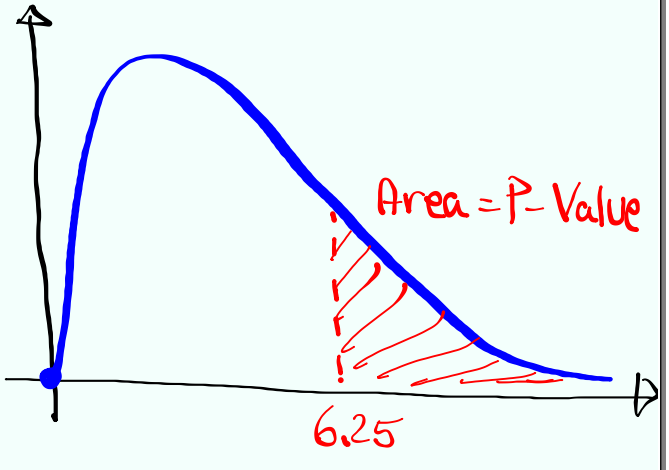
May 20-3:47 PM

CTS $F = 6.25$

RTT

NdF = 4, DdF = 7

find P-Value.



fcdf(6.25, E99, 4, 7)

$= .018$

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