Statistics

Lecture 13

Feb 19-8:47 AM

The College claims that 35% of all students are fan of Online classes. $P = .35 \leftarrow H_0$

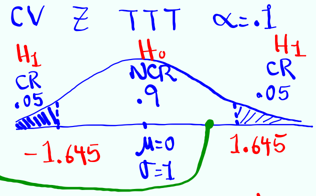
I surveyed 175 students and 40% of them were in favor of online classes. $n = 175$, $\hat{P} = .4 \rightarrow x = n\hat{p} = 175(.4) = \boxed{70}$

Use this survey to test the claim at $\boxed{\alpha = .1}$

$H_0: P = .35$ claim

$H_1: P \neq .35$ TTT

CV Z TTT $\alpha = .1$



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

CTS	$Z = 1.387$
P-Value	$P = .166$ ✓

1-Prop Z Test

P_0: .35

x: 70

n: 175

Prop $\neq P_0$ H_1

CTS is in NCR $\Rightarrow$ H_0 valid

P-value $> \alpha$ H_1 invalid

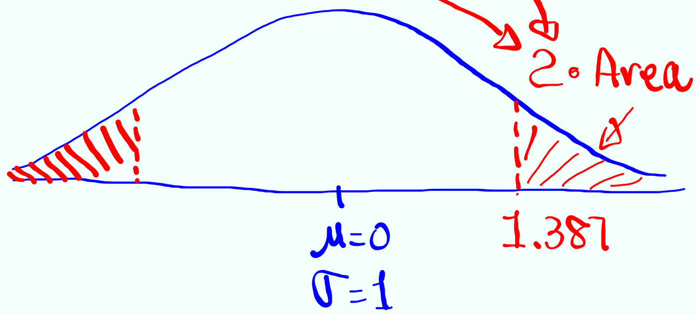
Valid claim

Fail-To-Reject

May 22-8:06 AM

Given: CTS $Z = 1.387$, TTT

Find p-value.



P-value $= 2 \cdot \text{normalcdf}(1.387, E99, 0, 1)$

$\approx \boxed{.165}$

May 22-8:20 AM

The College claims the mean age of all Students is at most 32.5 Yrs. $\mu \le 32.5$ ← H_0

I randomly Selected 40 Students, their mean age was 36.8 Yrs. $n = 40$ $\bar{x} = 36.8$

No α → .05

Use this Sample to test the claim assuming Standard deviation of ages of all Students is 8.8 Yrs. $\sigma = 8.8$

H_0: $\mu \le 32.5$ claim

H_1: $\mu > 32.5$ RTT

σ Known Case I

CV Z RTT $\alpha = .05$

CTS $Z = 3.090$

P-Value $P = 9.995 \times 10^{-4}$

Z-Test

inpt: Stats

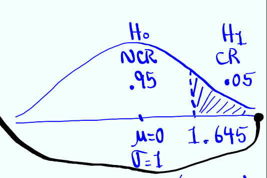
μ_0: 32.5

σ: 8.8

$\bar{x}$: 36.8

n: 40

$\mu > \mu_0$ H_1



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

CTS is in CR ⇒ H_0 invalid

P-value $\le \alpha$ ⇒ H_1 Valid

Invalid claim

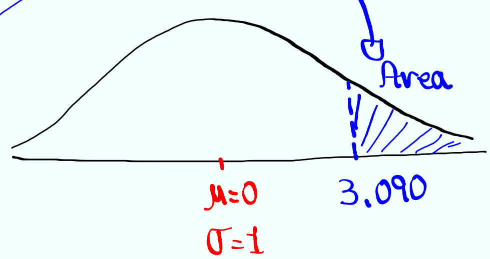
Reject

May 22-8:24 AM

CTS $Z = 3.090$

RTT

Find P-Value.



P-Value = normalcdf$(3.090, E99, 0, 1)$

$\approx \boxed{.001}$ ✓

From earlier ans

P-Value 9.995×10^{-4}

$= \boxed{0.000}995 \approx .001$

4

May 22-8:38 AM

The College claims the mean score on all math exams is below 85. $\mu < 85$ ← H_1

I took 10 exams and here are the scores.

75	82	86	90	70
68	88	85	100	55

→ $\bar{x} \approx 80$

$S \approx 13$ $n = 10$

no α → .05

Use this sample to test the claim.

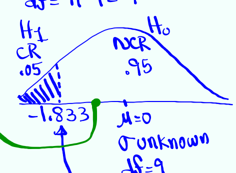
H_0: $\mu \geq 85$

H_1: $\mu < 85$ claim, LTT

σ unknown Case II

CV t LTT $\alpha = .05$

$df = n - 1 = 9$



$t = \text{invT}(.05, 9)$

CTS $t = -1.216$

P-Value $P = .127$ ✓

T-Test

inpt: Stats

$\mu_0 = 85$

$\bar{x} = 80$

$S = 13$

$n = 10$

$\mu < \mu_0$ H_1

CTS is in NCR

$\boxed{\text{P-Value} > \alpha}$ ⇒ H_0 Valid

H_1 invalid

Invalid claim

Reject

What α values will reverse the conclusion? $.127 \leq \alpha$

we need P-Value $\leq \alpha$

choose $.13, .14, .15, \ldots$

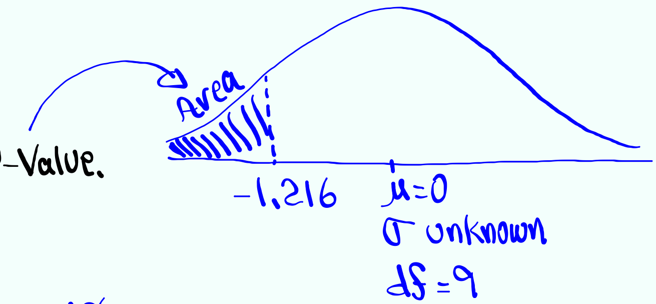
May 22-8:45 AM

CTS $t = -1.216$

LTT

$df = 9$

find p-Value.



$\text{P-Value} = \text{tcdf}(-E99, -1.216, 9) \approx \boxed{.127}$

SG 24 & 25

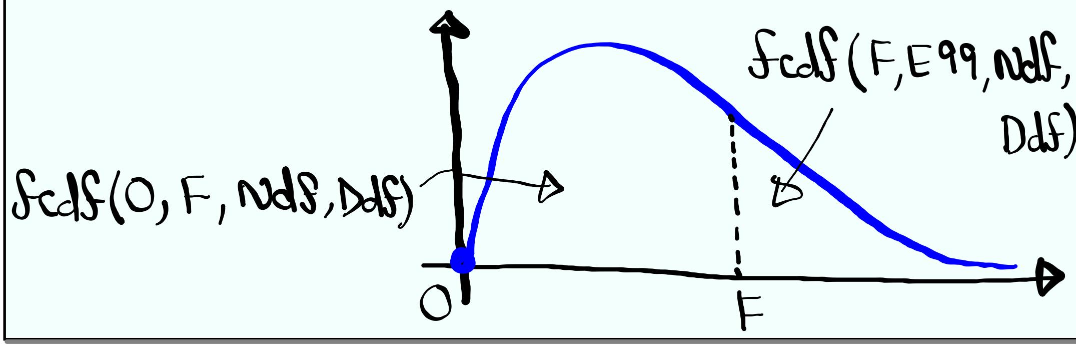
May 22-9:01 AM

F Dist.

1) Graph begins at 0 and it is positively Skewed

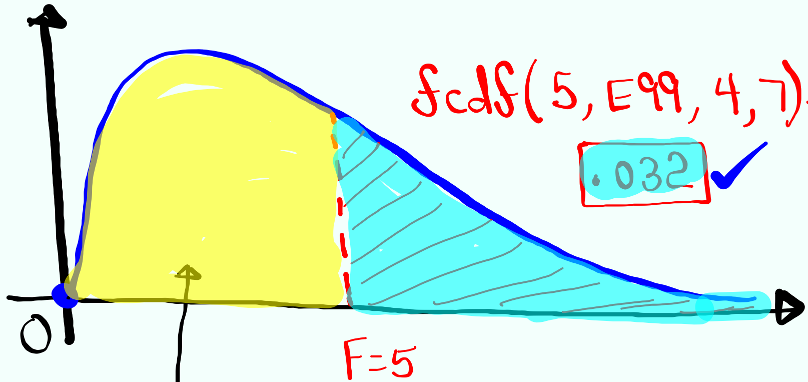
2) Not Symmetric but has total area 1.

3) It comes with two degrees of Freedom
Ndf & Ddf



May 22-9:24 AM

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

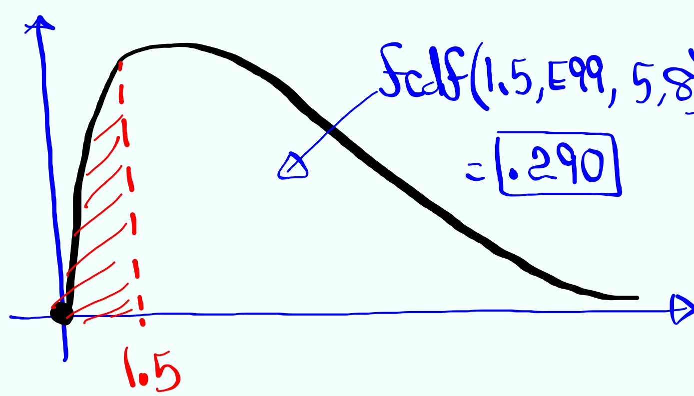


$\text{fcdf}(5, E99, 4, 7) = \boxed{.032}$

$P(F<5) = \text{fcdf}(0, 5, 4, 7) = \boxed{.968}$

May 22-9:29 AM

find $P(F<1.5)$ with Ndf= 5 & Ddf=8.



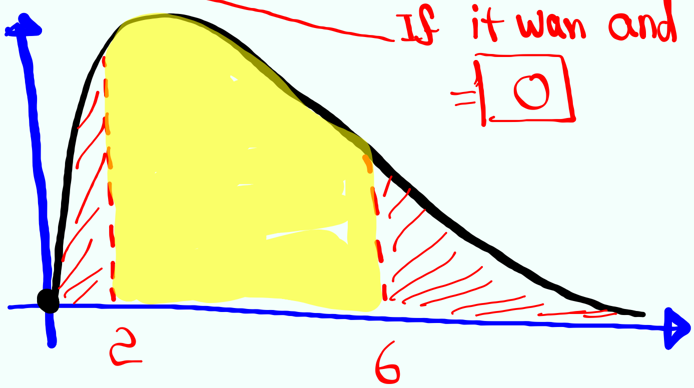
$\text{fcdf}(1.5, E99, 5, 8) = \boxed{.290}$

$= \text{fcdf}(0, 1.5, 5, 8) = \boxed{.710}$

May 22-9:33 AM

Find $P(F<2 \text{ or } F>6)$ with $Ndf=6$, and $Ddf=4$.

If it wan and $= \boxed{0}$



Total Prob.

$= 1 - P(2<F<6) = 1 - \text{Fcdf}(2,6,6,4)$

$= \boxed{.791}$

May 22-9:36 AM

Find the area on each side of $F=3.5$ with $Ndf=7$ & $Ddf=9$.

then multiply the Smaller area by 2.

$\text{Fcdf}(3.5, E99, 7, 9)$

$= \boxed{.042}$

$\text{Fcdf}(0, 3.5, 7, 9)$

$= \boxed{.958}$

$2 \cdot \text{Smaller area} = 2(.042) = \boxed{.084}$

May 22-9:40 AM

Comparing two Population Standard deviations:

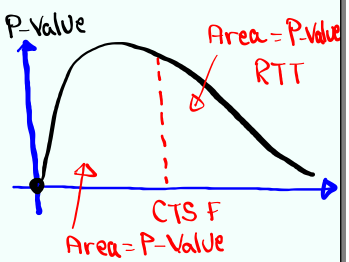
$H_0: \sigma_1 = \sigma_2$	$H_0: \sigma_1 \leq \sigma_2$	$H_0: \sigma_1 \geq \sigma_2$
$H_1: \sigma_1 \neq \sigma_2$	$H_1: \sigma_1 > \sigma_2$	$H_1: \sigma_1 < \sigma_2$
TTT	RTT	LTT

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

$\boxed{S_1 > S_2}$

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

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



P-Value Method

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

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

For TTT
Multiply the Smaller area by 2.

May 22-9:46 AM

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

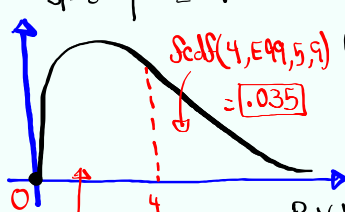
Group 1	Group 2
$n_1 = 6$	$n_2 = 10$
$S_1 = 8$	$S_2 = 4$

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

No $\alpha \rightarrow .05$

$S_1 > S_2$ ✓



Fcdf(4, E99, 5, 9) $= \boxed{.035}$

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

$Ndf = n_1 - 1 = 5$

$Ddf = n_2 - 1 = 9$

Fcdf(0, 4, 5, 9) $= \boxed{.965}$

P-Value $= 2 \cdot$ Smaller area
$= 2(.035) = \boxed{.07}$

$\boxed{\text{P-Value} > \alpha}$ ($.07$, $.05$) $\Rightarrow$ H_0 Valid $\rightarrow$ Valid claim
H_1 invalid   FTR the claim

Suggest α values to reverse the conclusion.

we need
P-Value $\leq \alpha$ $\rightarrow$ $.07 \leq \alpha$
Choose α to be
$.08$, $.09$, $.10$, ...

May 22-9:56 AM

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

$\boxed{\text{STAT}}$

$\boxed{\text{TESTS}}$

$\boxed{\text{2-SampFTest}}$

Inpt: $\boxed{\text{Stats}}$

$S_1=8$

$n_1=6$

$S_2=4$

$n_2=10$

$\sigma_1 \neq \sigma_2$ H_1

CTS $F=4$

P-Value $P=.069$

May 22-10:06 AM

Standard dev. of 8 exams by female students was 9.
$n=8$ $S=9$

Standard dev. of 10 exams by male students was 6.
$n=10$ $S=6$

Test the claim at $\alpha=.02$ that there is a difference between two Pop. standard deviations.

Females	Males
$n_1=8$	$n_2=10$
$S_1=9$	$S_2=6$

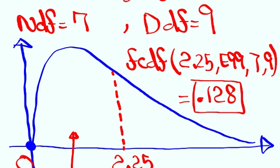
$S_1 > S_2$

$H_0: \sigma_1 = \sigma_2$

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

CTS $F=\frac{S_1^2}{S_2^2}=\frac{9^2}{6^2}=2.25$

NDF$=7$, DDF$=9$



fcdf(2.25, E99, 7, 9) $= \boxed{.128}$

fcdf(0, 2.25, 7, 9) $= \boxed{.972}$

P-Value $=2(.128)=\boxed{.256}$

P-Value $>$ α
.256 .02

H_0 valid & H_1 invalid

Invalid claim $\rightarrow$ $\boxed{\text{Reject}}$

Use 2-SampFTest, find

CTS $F=2.25$

P-Value $P=.256$

May 22-10:09 AM

Stand. dev. of ages of 8 Female nurses was 10 Yrs. $n=8$ $S=10$

Stand. dev. of ages of 8 male nurses was 4 Yrs. $n=8$ $S=4$

Use $\boxed{\alpha=.1}$ to test the claim that Standard dev. of ages of all Female nurses is greater than the Standard dev. of ages of all male nurses.

$\sigma_1 > \sigma_2$ — H_1

Females	Males
$n_1=8$	$n_2=8$
$S_1=10$	$S_2=4$

$S_1 > S_2$

H_0: $\sigma_1 \le \sigma_2$

H_1: $\sigma_1 > \sigma_2$ claim RTT

2-Samp FTest

$\sigma_1 > \sigma_2$

$\boxed{\text{CTS } F=6.25 \quad \text{P-Value } P=.014}$

$\boxed{\text{P-Value} \le \alpha}$

.014 .1

H_0 invalid

H_1 Valid Valid claim → FTR the claim

Suggest a value for α to reject the claim.

we need

P-Value > α → $.014 > \alpha$

choose $\alpha=.01$

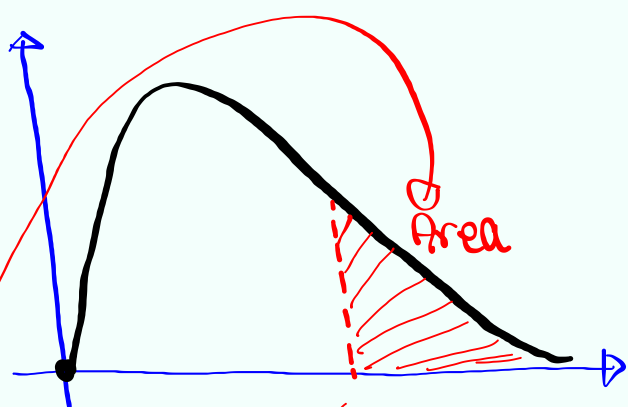
May 22-10:23 AM

CTS $F=6.25$

RTT

NdF=7 , DdF=7

Find P-Value.



P-Value = Fcdf(6.25, E99, 7, 7) = $\boxed{.014}$

May 22-10:34 AM