Statistics

Lecture 14

Feb 19-8:47 AM

The College claims that the GPA for all students has an average of at least 2.85.

H_0 $\mu \geq 2.85$

I took a sample of 30 students, the average GPA of them was 2.65. It is known that standard dev. of all GPA of students is .75.

$n = 30$
$\bar{x} = 2.65$
$\sigma = .75$

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

$H_0: \mu \geq 2.85$ claim

$H_1: \mu < 2.85$ LTT

$\boxed{\begin{array}{l}\text{CTS } Z = -1.461 \\ \text{P-Value } P = .072\end{array}}$

Z-Test

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

$\mu_0 : 2.85$ H_0

$\sigma = .75$

$\bar{x} = 2.65$

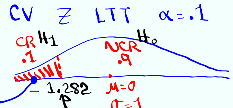
$n = 30$

μ $\boxed{< \mu_0}$ H_1

$\boxed{\text{Calculate}}$

σ Known $\rightarrow$ Case I

CV Z LTT $\alpha = .1$



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

CTS is in CR

P-value $\leq \alpha$

Testing Chart $\begin{cases} \rightarrow H_0 \text{ invalid} \\ \rightarrow H_1 \text{ valid} \end{cases}$

Invalid claim

Reject the claim

If we wish to reverse this conclusion

$\Rightarrow$ P-Value $> \alpha$ $\Rightarrow$ $.072 > \alpha$

New α could be .07, .06, .05, .04, .03, .02, .01

Dec 5-8:09 AM

I randomly Selected 12 exams, here are the Scores

73	85	100	92
90	65	55	88
100	75	80	98

Find
1) $\bar{x} \approx 83$
2) $S \approx 14$
Round to whole #.

No $\alpha \to .05$

Test the claim that the mean of all Scores is not 80.

$\mu \neq 80$ — H_1

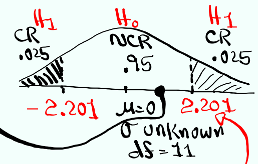
H_0: $\mu = 80$

H_1: $\mu \neq 80$ claim, TTT

σ unknown → Case II

CV t TTT $\alpha = .05$

$df = n - 1 = 12 - 1 = 11$



CV $t = \text{invT}(.975, 11)$

CTS $t = .742$
P-Value $P = .473$ ✓

T-Test

inpt: $\boxed{\text{Stats}}$
μ_0: 80 H_0
$\bar{x} = 83$
$S = 14$
$n = 12$
μ $\boxed{\neq \mu_0}$ H_1

CTS is in NCR, P-Value > α

Testing Chart ⇒ H_0 Valid, H_1 Invalid

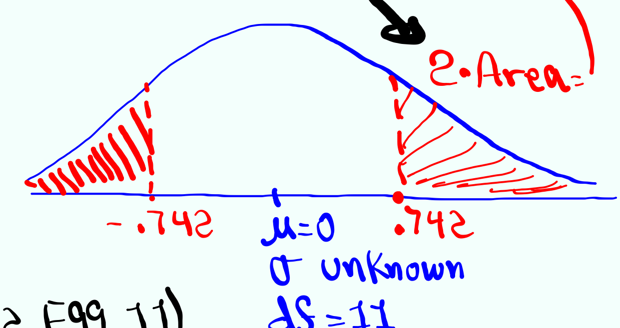
Invalid claim

Reject the claim

Dec 5-8:26 AM

CTS $t = .742$ TTT $df = 11$

Find the Corresponding P-Value



P-Value = $2 \cdot \text{tcdf}(.742, E99, 11)$

$= \boxed{.474}$

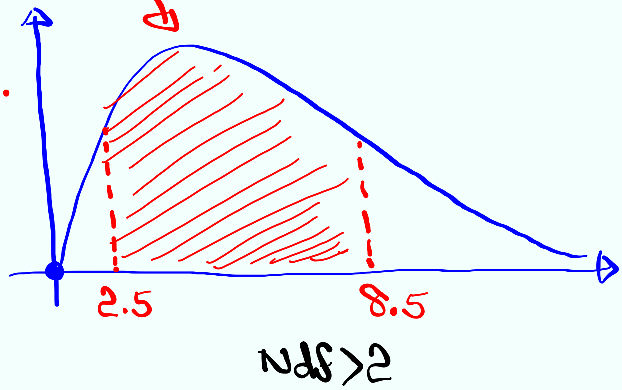
Dec 5-8:42 AM

Find $P(2.5 < F < 8.5)$ with Ndf $= 4$ & Ddf $= 24$.

F-Dist.

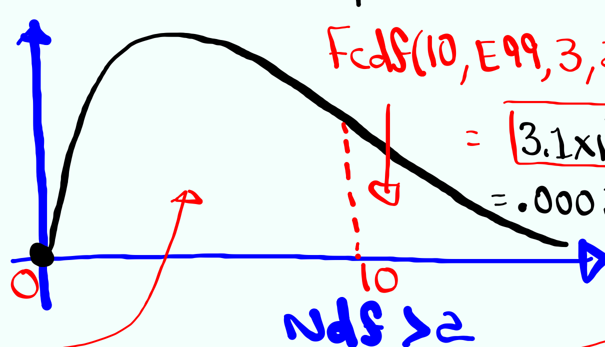
$= \text{Fcdf}(2.5, 8.5, 4, 24)$

$= \boxed{.069}$



Dec 5-8:47 AM

Find the area on each side of $F = 10$ with Ndf $= 3$ & Ddf $= 20$, then multiply the Smaller area by 2.



$\text{Fcdf}(10, E99, 3, 20)$

$= \boxed{3.1 \times 10^{-4}}$

$= .00031$

$\text{Fcdf}(0, 10, 3, 20)$

$= .99969\ldots = \boxed{.9997}$

$2 \cdot \text{Smaller area} = \boxed{6.188 \times 10^{-4}}$

Dec 5-8:52 AM

SG 29

Comparing two Population Standard deviations: $\underbrace{}_{\sigma_1 \ \& \ \sigma_2}$

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

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

1) $S_1 > S_2$

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

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

CTS F

P-Value p

$\boxed{\text{STAT}}$ $\boxed{\text{TESTS}}$ $\Rightarrow$ 2-SampFTest

use P-Value method to proceed.

Dec 5-9:11 AM

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

no $\alpha \to .05$

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 10$
$S_1 = 6$	$S_2 = 5$

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

1) $S_1 > S_2$ ✓

2) $Ndf = n_1 - 1 = 7$, $Ddf = n_2 - 1 = 9$

3) CTS $F = \dfrac{S_1^2}{S_2^2} = \dfrac{6^2}{5^2} = 1.44$ ✓

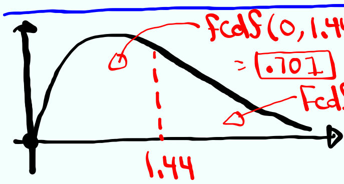
$\boxed{\text{STAT}}$ $\boxed{\text{TESTS}}$

2-SampFTest

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

⋮

$\sigma_1 \boxed{\neq} \sigma_2$



fcdf(0,1.44,7,9) = $\boxed{.701}$

Fcdf(1.44,E99,7,9) = $\boxed{.299}$

CTS F = 1.44
P-Value p = .597

TTT $\to$ P-Value $= 2 \cdot (.299) = \boxed{.598}$

H_0 Valid, H_1 invalid

Valid claim, FTR

Dec 5-9:18 AM

Standard deviation of ages of 10 randomly selected female students was 9. $n=10$ $S=9$ ✓

Standard deviation of ages of 15 randomly selected male students was 4. $n=15$ $S=4$ ✓✓

use $\alpha = .02$ to test the claim that population standard deviations are different. $\sigma_1 \neq \sigma_2$ H_1

$H_0: \sigma_1 = \sigma_2$

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

Females	Males
$n_1=10$	$n_2=15$
$S_1=9$	$S_2=4$

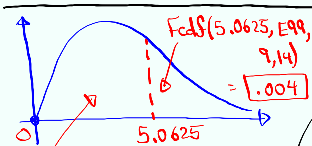
1) $S_1 > S_2$ ✓

2) $Ndf = n_1 - 1 = 9$, $Ddf = n_2 - 1 = 14$

3) CTS $F = \frac{S_1^2}{S_2^2} = \frac{9^2}{4^2} = \boxed{5.0625}$ ✓

2-SampFTest

$\boxed{\begin{array}{l}\text{CTS } F = 5.0625 \\ \text{P-Value } p = .007\end{array}}$



Fcdf(5.0625, E99, 9,14) = $\boxed{.004}$

Fcdf(0, 5.0625, 9, 14) = $\boxed{.996}$

TTT → $2\cdot(.004) = \boxed{.008}$

P-Value $\leq \alpha$

H_0 invalid, H_1 Valid

Valid claim

FTR the claim

Dec 5-9:30 AM

use the chart below to test the claim $\boxed{\sigma_1 > \sigma_2}$ H_1

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

NO α → .05

$H_0: \sigma_1 \leq \sigma_2$

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

$S_1 > S_2$ ✓

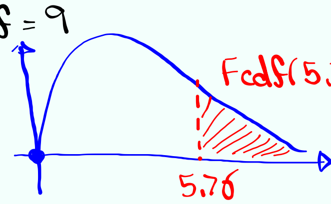
CTS $F = \frac{S_1^2}{S_2^2} = \frac{12^2}{5^2} = 5.76$

Ndf = 9

Ddf = 9

2-SampFTest

$\boxed{\begin{array}{l}\text{CTS } F = 5.76 \\ \text{P-value } p = .008\end{array}}$ ✓



Fcdf(5.76, E99, 9, 9) = $\boxed{.008}$ ✓

P-value $\leq \alpha$

H_0 invalid H_1 Valid

Valid claim → FTR

SG 29 ✓

Double-Points

Dec 5-9:45 AM