Statistics

Lecture 17

Feb 19-8:47 AM

Comparing two Population standard deviations

SG 29

$H_0: \sigma_1 = \sigma_2$ | $H_0: \sigma_1 \geq \sigma_2$ | $H_0: \sigma_1 \leq \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ | $H_1: \sigma_1 < \sigma_2$ | $H_1: \sigma_1 > \sigma_2$

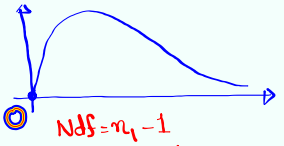
TTT | LTT | RTT

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

$S_1 > S_2$

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

Use F-Dist.



$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

CTS F

P-Value P

2-Samp F Test

By P-Value Method

If P-Value $> \alpha$ $\rightarrow H_0$ Valid, H_1 invalid

If P-Value $\leq \alpha$ $\rightarrow H_0$ invalid, H_1 Valid

Final Conclusion must be made about claim

Reject the claim OR FTR the claim

Jul 30-4:35 PM

Use chart below

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 10$
$s_1 = 12$	$s_2 = 6$

1) Verify $s_1 > s_2$ ✓

2) CTS $F = \frac{s_1^2}{s_2^2} = \frac{12^2}{6^2} = 4$

3) $Ndf = n_1 - 1 = 8 - 1 = 7$

$Ddf = n_2 - 1 = 10 - 1 = 9$

Use $\alpha = .1$ to test the claim that $\sigma_1 = \sigma_2$.

H_0: $\sigma_1 = \sigma_2$ claim

H_1: $\sigma_1 \neq \sigma_2$ TTT

CTS $F = 4$

P-Value $P = .058$ ✓

STAT → TESTS → 2-SampFTest

Inpt: Stats

$s_1 = 12$

$n_1 = 8$

$s_2 = 6$

$n_2 = 10$

$\sigma_1 \neq \sigma_2$ H_1

Calculate

P-Value Method

P-Value $\leq \alpha$

$.058$ $.1$

H_0 invalid H_1 Valid

Invalid claim ⇒ Reject the claim

I want to support the claim

P-Value $> \alpha$

$.058 > \alpha$

we choose α to be

$.05, .04, .03, .02, .01$

H_0 Valid → Valid claim

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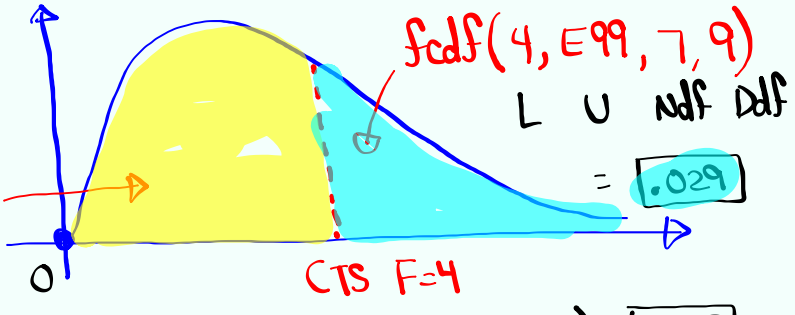
How to verify the P-Value

CTS $F = 4$ $Ndf = 7$ $Ddf = 9$ TTT

F-Dist.

fcdf(0, 4, 7, 9)

= .971



P-Value = 2 · Smaller area = 2(.029) = .058

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Standard deviation of ages of 10 randomly Selected Female students was 8. $n=10$, $S=8$

Standard deviation of ages of 12 randomly Selected male students was 5. $n=12$, $S=5$

1) Who becomes group 1? $S_1 > S_2$ Females

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

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

3) $ndf=n_1-1=9$

4) $Ddf=n_2-1=11$

No $\alpha \rightarrow .05$

5) Test the claim that two standard deviations are equal.

$H_0: \sigma_1=\sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS $F=2.56$

P-Value $P=.144$ ✓

2-Samp F Test

Input: Stats

$S_1=8$

$n_1=10$

$S_2=5$

$n_2=12$

$\sigma_1 \neq \sigma_2$ H_1

Calculate

P-Value $>$ α

.144 .05

H_0 Valid H_1 invalid

Valid claim $\rightarrow$ FTR the claim

If we choose $\alpha=.15, .16, .17, .18, .19, .20, \ldots$

P-Value $\leq \alpha$

H_0 invalid $\rightarrow$ invalid claim $\rightarrow$ Reject the claim

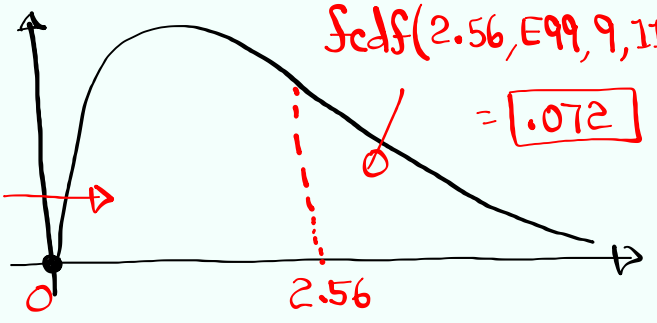
Jul 30-5:03 PM

CTS $F=2.56$ $ndf=9$ $Ddf=11$ TTT

Find P-Value.

fcdf(0, 2.56, 9, 11)

$=$ .928



P-Value $= 2 \cdot$ Smaller area $= 2 \cdot (.072) =$ .144

Jul 30-5:15 PM

Scores of exams by 10 Female Students are

82 95 100 75 80

70 75 90 100 60

$\Rightarrow n = 10$, $S = 13$ (Round to whole number)

Scores of exams by 10 male students are

80 50 92 40 100

75 88 95 68 90

$\Rightarrow n = 10$, $S = 20$

Males	Females
$n_1 = 10$	$n_2 = 10$
$S_1 = 20$	$S_2 = 13$

use $\alpha = .02$ to test the claim that standard deviation of all males is greater than Standard deviation of all Females

$H_0: \sigma_1 \leq \sigma_2$

$H_1: \sigma_1 > \sigma_2$ claim RTT

CTS $F = 2.367$

P-Value $P = .108$

2-SampFTest

Input: Stats

$S_1 = 20$

$n_1 = 10$

$S_2 = 13$

$n_2 = 10$

$\sigma_1 > \sigma_2$ H_1

P-Value $>$ α

.108 > .02

H_0 Valid

H_1 invalid

Invalid claim

Reject the claim

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SG 33

Comparing At least 3 pop. means:

$H_0: \mu_1 = \mu_2 = \mu_3 = \cdots = \mu_K$

H_1: At least one mean is different. RTT

Method: ANOVA (Analysis of Variance)

K groups $\Rightarrow$ Ndf $= K - 1$

n total Sample Size $\Rightarrow$ Ddf $= n - K$

CTS F

P-Value P

STAT TESTS ↓ ANOVA(L1, L2, L3, ... Enter

P-Value $> \alpha$ $\Rightarrow H_0$ Valid, H_1 invalid

P-Value $\leq \alpha$ $\Rightarrow H_0$ invalid, H_1 Valid

Final Conclusion must be about the claim

Reject the claim, Fail-to-Reject the claim

When to use ANOVA:

when comparing at least 3 pop. means.

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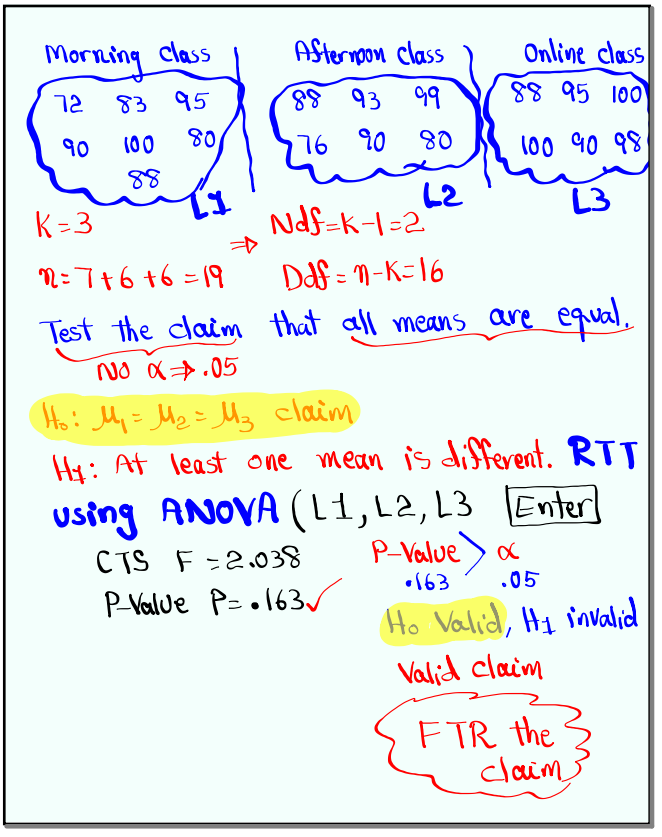

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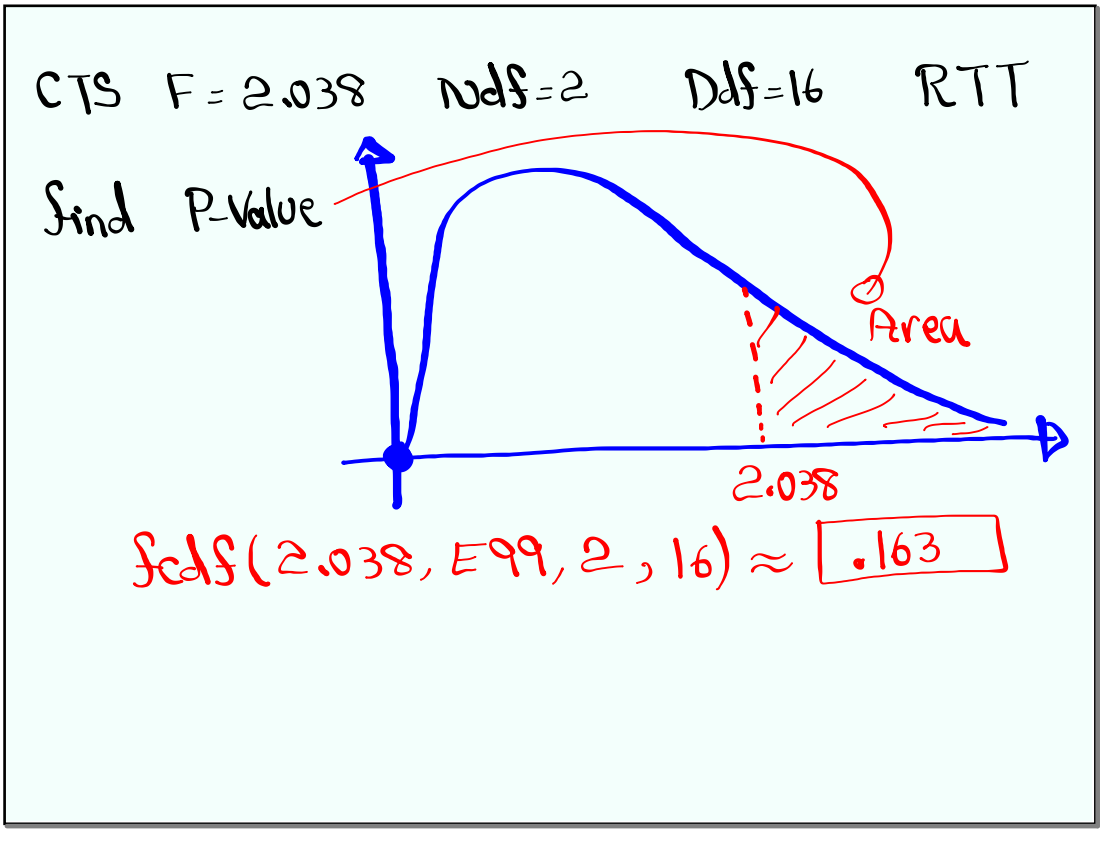

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Ages of randomly selected students from 4 schools are given below:

L1 Mt. SAC			L2 Chaffey			L3 ELAC			L4 UCLA			
21	25	19	18	29	31	17	23	28	34	40	28	
28	30	24	24	25		20	18	30	45	50	60	35

$k=4$

$n=6+5+6+7=24$ $\Rightarrow$ $Ndf=k-1=3$, $Ddf=n-k=20$

Use $\alpha=.1$ to test the claim that not all means are equal.

$H_0: \mu_1=\mu_2=\mu_3=\mu_4$

H_1: At least one mean is different. RTT claim

CTS $F=9.986$

P-Value $P=3.119\times10^{-4}$

ANOVA(L1, L2, L3, L4)

If a list is missing

STAT Edit

5:SetUpEditor Enter

P-Value $\leq \alpha$

3.1×10^{-4} $.1$

H_0 invalid H_1 valid

valid claim

FTR the claim

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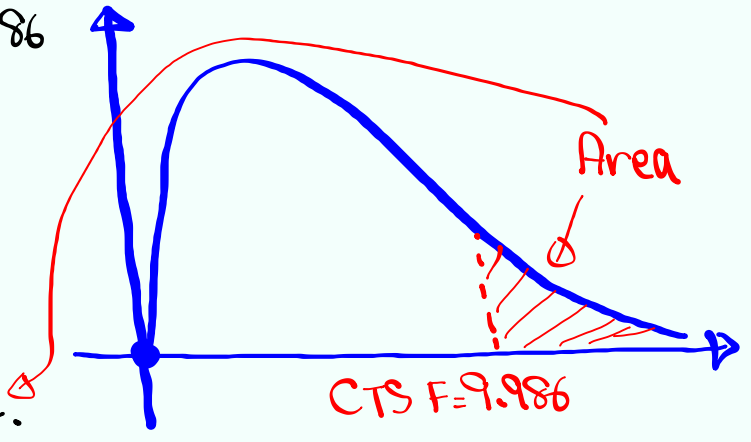
CTS $F=9.986$

$Ndf=3$

$Ddf=20$

RTT

Find P-Value.



$fcdf(9.986, E99, 3, 20) \approx 3.119\times10^{-4}$

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