Statistics

Lecture 27

Feb 19-8:47 AM

Testing One population Standard deviation

optional SG 3

$H_0: \sigma = \sigma_0$ | $H_0: \sigma \geq \sigma_0$ | $H_0: \sigma \leq \sigma_0$

$H_1: \sigma \neq \sigma_0$ | $H_1: \sigma < \sigma_0$ | $H_1: \sigma > \sigma_0$

TTT | LTT | RTT

CTS $\chi^2 = \dfrac{(n-1)s^2}{\sigma^2}$ $df = n-1$

P-Value

1) RTT χ^2cdf(CTS, E99, df)

2) LTT χ^2cdf(0, CTS, df)

3) TTT Find both Right & Left, Multiply Smaller area by 2.

P-Value Method only

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

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

Final Conclusion must be claim

Reject the claim

FTR the claim

May 28-1:50 PM

Given: $\boxed{H_0: \sigma \le 10}$, $\boxed{\text{claim is } H_0}$

$\alpha = .02$, $n = 12$, $S = 13$

$df = n-1$
$= 11$

Test the claim.

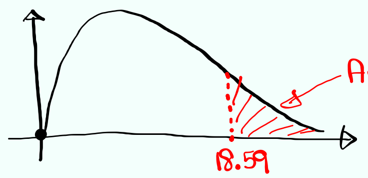
CTS

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

$H_0: \sigma \le 10$ claim

$H_1: \sigma > 10$ RTT

$$= \frac{(12-1)\cdot 13^2}{10^2} = 18.59$$



Area = P-Value

$\chi^2cdf(18.59, E99, 11)$

$= \boxed{.069}$

P-Value $> \alpha$
.069 .02

H_0 Valid,
H_1 invalid

Valid claim → FTR the claim

If we choose $\alpha = .1$
P-Value $\le \alpha$
H_0 invalid → Invalid claim
H_1 Valid Reject it.

May 28-1:58 PM

College claims that standard deviation of ages of all students is 12 Yrs.

$\sigma = 12$ claim
↑ H_0

I took a sample of 10 students, standard deviation of their ages was 9.

$n = 10$
$S = 9$

NO α → .05

$\boxed{\text{Test the claim.}}$

$df = n-1 = 9$

CTS $\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2}$

$H_0: \sigma = 12$ claim

$$= \frac{(10-1)\cdot 9^2}{12^2} = 5.0625$$

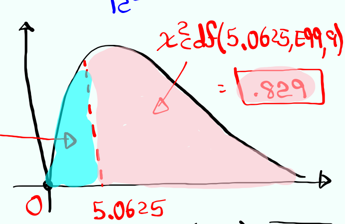
$H_1: \sigma \ne 12$ TTT

$\chi^2cdf(5.0625, E99, 9)$

$= \boxed{.829}$

$\chi^2cdf(0, 5.0625, 9)$

$= \boxed{.172}$



P-Value $= 2 \cdot$ Smaller area $= 2(.172) = \boxed{.344}$

P-Value $> \alpha$
.344 .05

H_0 Valid → Valid claim
H_1 invalid FTR the claim

May 28-2:06 PM

I randomly Selected 5 exams. Here are the Scores

75 83 97 100 90 → $n=5$

$df = n-1 = 4$

1) Find $\bar{x}$ & s. Round to whole #.

$\bar{x} = 89$

$s = 10.223 \approx 10$

2) use $\boxed{\alpha = .1}$ to test the claim that standard deviation of Scores of all exams is at least 14.

$\sigma \geq 14$ claim

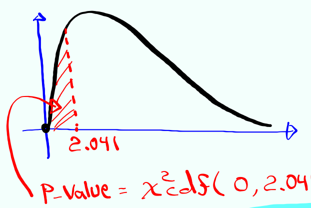
↑ H_0

$H_0: \sigma \geq 14$ claim

$H_1: \sigma < 14$ LTT

CTS

$$\chi^2 = \frac{(n-1) \cdot s^2}{\sigma^2} = \frac{(5-1) \cdot 10^2}{14^2} = \boxed{2.041}$$



P-Value = χ^2cdf$(0, 2.041, 4) = \boxed{.272}$

P-Value > α

.272 .1

H_0 Valid → Valid claim

H_1 invalid

FTR the claim

May 28-2:17 PM

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

① Organize information in a chart

Group 1	Group 2
n_1	n_2
S_1	S_2

$S_1 > S_2$

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

$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

3) P-Value

Fcdf(L, U, Ndf, Ddf)

2-Samp F Test

RTT

Fcdf(CTS, E99, Ndf, Ddf)

LTT

Fcdf(0, CTS, Ndf, Ddf)

TTT

Find both right & Left

Multiply Smaller area by 2.

4)

P-Value > α → H_0 Valid, H_1 invalid

P-Value ≤ α → H_0 invalid, H_1 Valid

5) Final Conclusion must be about the claim.

Reject the claim

FTR the claim

May 28-2:29 PM

Consider the chart below

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

1) verify $S_1 > S_2$. ✓

2) $Ndf = n_1 - 1 = 7$

$Ddf = n_2 - 1 = 5$

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

No $\alpha \to .05$

4) $\boxed{\text{Test the claim}}$ that $\sigma_1 = \sigma_2$.

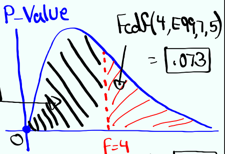
$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

P_Value

Fcdf(4,E99,7,5) $= \boxed{.073}$

Fcdf(0,4,7,5) $= \boxed{.927}$



P-Value = 2·Smaller area = 2(.073) = $\boxed{.146}$ ✓

P-Value > α

.146   .05

H_0 Valid → Valid claim

H_1 Invalid

FTR the claim

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

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

$S_1=10$

$n_1=8$

$S_2=5$

$n_2=6$

$\sigma_1 \neq \sigma_2$ H_1

$\boxed{\text{Calculate}}$

CTS F = 4

P-Value P = .146

May 28-2:38 PM

I randomly selected 10 Female students, standard deviation of their ages was 8 Yrs.

I randomly selected 15 males students, Standard deviation of their ages was 12 Yrs.

1)

Males Group 1	Females Group 2
$n_1=15$	$n_2=10$
$S_1=12$	$S_2=8$

No $\alpha \to .05$

2) $\boxed{\text{Test the claim}}$ that there is a difference in standard deviations, $\sigma_1 \neq \sigma_2$

$H_0: \sigma_1 = \sigma_2$

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

2-SampFTest

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

$S_1=12$ $n_1=15$

$S_2=8$ $n_2=10$

$\sigma_1 \neq \sigma_2$

$\boxed{\text{CTS } F = 2.25 \quad \text{P-Value } P = .224 ✓}$

P_Value > α

.224   .05

H_0 Valid

H_1 invalid

Invalid claim

Reject the claim

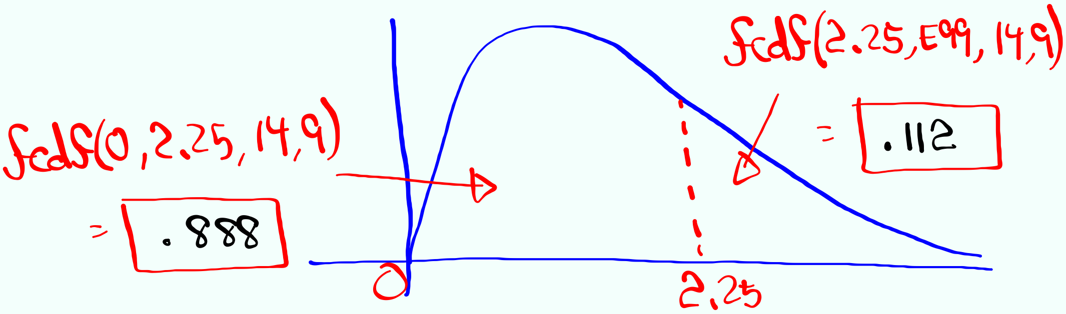
May 28-2:51 PM

1)

Group 1	Group 2
$n_1 = 15$	$n_2 = 10$
$S_1 = 12$	$S_2 = 8$

CTS $F = \frac{S_1^2}{S_2^2} = \frac{12^2}{8^2} = 2.25$

Ndf = 14   Ddf = 9



P-Value = 2 · Smaller area = 2(.112) = $\boxed{.224}$

May 28-3:02 PM

I randomly Selected exams from two different classes.

In - Person			Online		
78	70	83	65	75	95
87	100	90	98	55	80
95	98	68	85	100	100
	100			95	
$n = 10$			$n = 10$		
$\bar{x} = 87$			$\bar{x} = 85$		
$S = 12$			$S = 16$		

Round To whole #

use $\alpha = .02$ to test the claim that there is no difference between two pop. Standard dev.

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS $F = 1.778$
P-Value $P = .404$

2-SampFTest
inpt: Stats
$S_1 = 16$ $n_1 = 10$
$S_2 = 12$ $n_2 = 10$
$\sigma_1 \neq \sigma_2$

P-Value > α
.404   .02

H_0 valid, H_1 invalid

Valid claim

FTR the claim

May 28-3:06 PM