Statistics

Fall 2021

Lecture 29

Comparing Two Population standard deviations σ_1 & σ_2 :

Sample 1	Sample 2
S_1	S_2
n_1	n_2

$S_1 > S_2$

$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

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

$H_0: \sigma_1 = \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS F

P-Value P ⇒ 2-SampFTest

Proceed with Testing chart

Final Conclusion.

Consider the chart below

Sample 1	Sample 2
$S_1 = 8$	$S_2 = 5$
$n_1 = 10$	$n_2 = 7$

① Verify $S_1 > S_2$ ✓

② Find CTS $F = \frac{S_1^2}{S_2^2}$

$F = \frac{8^2}{5^2} = \boxed{2.56}$

③ Test the claim that $\sigma_1 = \sigma_2$ using $\alpha = .02$.

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

CTS $F = 2.56$

P-Value $P = .265$

STAT TESTS

2-SampFTest

Inpt: STATS

$S_1 = 8$ $n_1 = 10$

$S_2 = 5$ $n_2 = 7$

$\sigma_1 \neq \sigma_2$ Calculate

Using P-Value only

P-Value > α Ho Valid Valid Claim

H1 invalid Fail-to-reject the claim

Exam 1: $n = 8$ $S = 10$

Exam 2: $n = 12$ $S = 15$

Use $\alpha = .1$ to test the claim that two population standard deviations are not equal.

$H_0: \sigma_1 = \sigma_2$

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

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

$S_1 > S_2$

CTS $F = \frac{S_1^2}{S_2^2} = \frac{15^2}{10^2} = 2.25$ ✓

Ndf $= 12 - 1 = 11$

Ddf $= 8 - 1 = 7$

2-SampFTest

CTS $F = 2.25$

P-Value $P = .297$

P-value method only:

P-Value > α

Ho valid & H1 invalid

invalid Claim

Reject the Claim

I randomly selected 10 female students, and standard deviation of their ages was 18 Yrs. Females: $n=10$, $S=18$

I also randomly selected 15 male students, and standard deviation of their ages was 4 Yrs. Males: $n=15$, $S=4$

Test the claim that two pop. standard deviations are equal.

no α ⇒ use .05

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

Females	Males
$n_1=10$	$n_2=15$
$S_1=18$	$S_2=4$

$S_1 > S_2$

NDF = 10−1 = 9

DDF = 15−1 = 14

CTS $F = \frac{S_1^2}{S_2^2} = \frac{18^2}{4^2} = 20.25$ ✓

CTS $F = 20.25$

P-Value $P = 3.05 \times 10^{-6}$

2-SampF Test

P-value < α

3×10^{-6} .05

$0.000003 < .05$

H_0 invalid → Invalid claim

H_1 Valid

Reject the claim

Comparing at least 3 population means:

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

H_1: At least one mean is different. RTT

K → # of groups

n → Total Sample Size

⇒ NDF = K−1

DDF = n−K

CTS F =

P-Value P =

⇒ STAT TESTS ANOVA(L1, L2, L3, ...

Name of the method

Analysis of Variance

Use Testing chart, and P-value method to proceed.

October 20, 2021

ELAC		Mt. SAC		Chaffey	
23	28	19	25	26	32
32	45	34	40	40	35
18	35	48	28	20	
		30			

$K = 3$

$n = 6 + 7 + 5 = 18$

$Ndf = K - 1 = 2$

$Ddf = n - K = 15$

Use $\alpha = .02$ to test the claim that all pop. means are equal.

ELAC → L1
Mt. SAC → L2
Chaffey → L3

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

H_1: At least one mean is different. RTT

STAT | TESTS | ↑ | ANOVA(L1, L2, L3 | Enter

2nd 1, 2nd 2, 2nd 3

CTS $F = .071$
P-Value $P = .931$

P-Value $> \alpha$
$.931 \quad .02$

⇒ H_0 Valid → Valid claim
H_1 invalid

FTR the claim

If we choose $\alpha = .932$, then

P-Value $\leq \alpha$
$.931 \quad .932$

⇒ H_0 invalid → invalid claim
H_1 valid

Reject the claim

I randomly selected exams from 4 different classes. Here are the scores:

Morning Class (L1)			Afternoon class (L2)			Evening class (L3)		Weekend class (L4)	
78	85	93	88	95	62	74	65	76	70
68	100	80		75	80	100	86	68	80
	90	70				90	94	50	55

$K = 4$

$n = 8 + 5 + 6 + 6 = 25$

⇒ $Ndf = K - 1 = 3$ Factor
$Ddf = n - K = 21$ Error

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

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

H_1: At least one pop. mean is different. ← claim. RTT

Morning → L1
Afternoon → L2
Evening → L3
Weekend → L4

STAT TESTS ANOVA(L1, L2, L3, L4 Enter

⇒ CTS $F = 2.922$
P-Value $P = .058$

P-Value Method only:

P-Value $\leq \alpha$
$.058 \quad .1$

H_0 invalid
H_1 Valid

Valid claim ⇒ FTR the claim

to reject the claim
P-Value $> \alpha$
$.058 > \alpha$

we need α to be
$.05$, $.04$, $.03$, $.02$, or $.01$

ANOVA does not tell us which mean is different.