Statistics
Spring 2023
Lecture 56

SG 35

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

Method: Analysis of Variance (ANOVA)

$K \rightarrow$ # of groups/Samples $\quad NDF = K-1$

$n \rightarrow$ Total Sample Size $\Rightarrow DDF = n-K$

P-Value method only:

CTS F
P-Value P $\Rightarrow$ ANOVA(L1, L2, L3, ...)

Proceed with testing chart

Draw final conclusion about claim.

Students were randomly selected from 4 different Colleges. Here are their ages:

ELAC		Mt. SAC			Santa Monica			Glendale		
21	32	18	28	20	21	27	30	18	24	29
19	30	34	20	19	32	25	35	32	25	39
25	40		45	40		38				
	20									

1) $K = 4$

$n = 7 + 8 + 7 + 6 = 28$ $\Rightarrow$ $Ndf = K - 1 = 3$, $Ddf = n - K = 24$

2) Test the claim at $\alpha = .02$ that not all means are equal.

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

H_1: At least one mean is different. claim, RTT

ELAC → L1
Mt. SAC → L2
Santa Monica → L3
Glendale → L4

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

CTS F = .160
P-value P = .922

P-value $>$ α $\Rightarrow$ H_0 Valid, H_1 Invalid

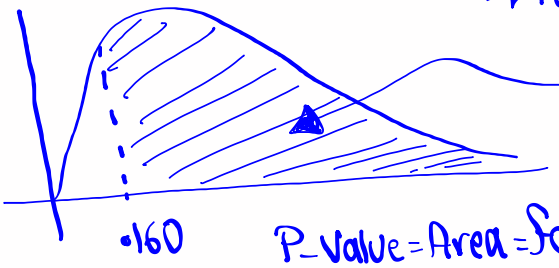
.922 > .02

Invalid claim
Reject the claim

Suppose we are comparing 4 population means with total sample size 28 and CTS F = .160. Find its p-value

$K = 4$, $n = 28$ $\Rightarrow$ $Ndf = K - 1 = 3$, $Ddf = n - K = 24$

Comparing at least 3 means
$\Rightarrow$ ANOVA
$\Rightarrow$ RTT



P-value = Area = fcdf(.160, E99, 3, 24)

= .922

Use the chart below to answer the following questions:

Sample 1	Sample 2
$n_1 = 12$	$n_2 = 15$
$S_1 = 18$	$S_2 = 8$

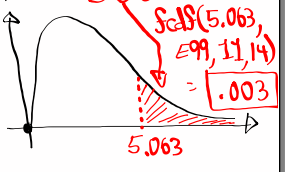
1) Verify $S_1 > S_2$. ✓

2) $Ndf = n_1 - 1 = 11$

$Ddf = n_2 - 1 = 14$

3) CTS $F = \frac{S_1^2}{S_2^2} = \frac{18^2}{8^2} = 5.063$

4) Find P-Value for RTT



fcdf(5.063, E99, 11, 14) = .003

5) Use 2-SampF Test for RTT.

CTS $F = 5.0625 \approx 5.063$

P-Value $P = .003$

H_0: $\sigma_1 \leq \sigma_2$

H_1: $\sigma_1 > \sigma_2$ RTT

6) Draw conclusion is H_1 is the claim

P-Value $\leq \alpha$

.003 .05

H_0 invalid H_1 valid

FTR the claim

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10 exams from morning class had a standard deviation of 7.5.

8 exams from evening class had a standard deviation of 8.5.

1)

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 10$
$S_1 = 8.5$	$S_2 = 7.5$

$S_1 > S_2$

2) Use $\alpha = .1$ to determine whether two Population Standard deviations are equal or not.

H_0: $\sigma_1 = \sigma_2$

H_1: $\sigma_1 \neq \sigma_2$ TTT

CTS $F = 1.284$

P-Value $P = .710$

P-Value $> \alpha$

.710 .1

H_0 valid H_1 invalid

$\sigma_1 = \sigma_2$

Two Pop. Stand. Dev. are equal. 2-Samp F Test

Class QZ 14

Use the chart below with ANOVA to find

L1		L2		L3	
50	52	55	59	84	86
54	70	63	77	90	100
75	68	70	65	100	95
65		68		98	

CTS $F = 31.865$

P-Value $P = 1.2 \times 10^{-6}$

STAT TESTS

ANOVA(L1, L2, L3)

Enter