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ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	SS	Fdf	MS	F "F- Cal "	P "p-value"
Within Groups	SSE	Edf	MSE		
Total	SS+SSE	FdF+Edf			

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.914	Fdf	Edf	P "p-value"

Not the Same

F-Calc:

- F=MS/MSE

Tukey-Kramer:

- Critical Range ="F-Stat" $*[(MSE/2)*((1/n_1)+(1/n_2))]^{0.5}$
- $|X_{n1}-X_{n2}|$>Critical Range then significant difference
- "*(asterisk)" represents significant difference
- Sig. "p-value" < α=0.05 or other levels of significance represents significant difference

Multiple Comparisons

Dependent Variable: mpg
Tukey HSD

(I) rep78	(J) rep78	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
3	4	-2.24	1.676	.382	-6.28	1.80
	5	-7.94*	1.974	.001	-12.69	-3.18
4	3	2.24	1.676	.382	-1.80	6.28
	5	-5.70*	2.123	.026	-10.81	-.58
5	3	7.94*	1.974	.001	3.18	12.69
	4	5.70*	2.123	.026	.58	10.81

Based on observed means.
*. The mean difference is significant at the .050 level.

Levene "*Precondition for ANOVA*"

- $H_0: \sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \ldots \sigma_n^2$
- H_1: Not all σ_j^2 are equal (j=1,2,3,...n)
- Reject H_0 if p-value<α=0.05 or other levels of Sig.
- If you fail to reject then ANOVA is justified.
- Homogeneity of variance has been satisfied.

ANOVA

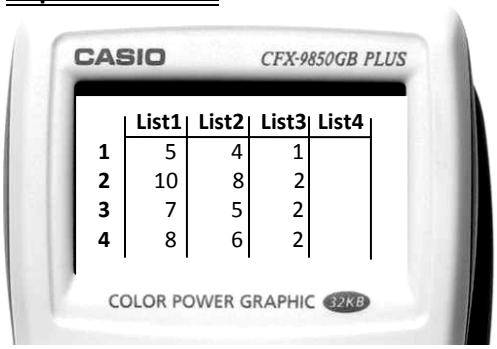
- $H_0: \mu_1 = \mu_2 = \mu_3 = \ldots \mu_n$ where 1=red, 2=white, 3=brown...etc
- H_1: Not all μ_j^2 are equal where (j=1,2,3,...n)
- Reject H_0 if p-value<α=0.05 or other levels of Sig. *(if using p-value approach)*
- Reject H_0 if F-cal>F-crit *(if using test statistic approach)*
- If you fail to reject then ANOVA is justified.
- Homogeneity of variance has been satisfied.

F-Test: "*Precondition for dependent two sample t-test*"

- F-cal=variance$_1$/variance$_2$
- F-upper → Numerator is n_1-1 , Denominator is n_2-1
- F-lower=1/F-upper
- $H_0: \sigma_1^2 = \sigma_2^2$
- $H_1: \sigma_1^2 \neq \sigma_2^2$
- Reject H_0 if p-value<α=0.05 or other levels of Sig. *(if using p-value approach)*
- Reject H_0 if F-cal>F-crit upper or if F-cal<F-crit lower *(if using test statistic approach)*

Note: *If you fail to reject H_0, then there is not a significant difference in the population variance. Therefore, you may pool on the two independent t-test.*

Dependent T-test



- $H_0: \mu_D = 0$ where $\mu_D = \mu_1 - \mu_2$ [1=Before, 2=After]
- $H_1: \mu_D \neq 0$
- Reject H0 if t-cal>t-crit upper or if t-cal<-t-crit lower

To calculate the difference of the calculator: **Step 1:** Go to [Run] , **Step 2:** Push [OPTN] ,**Step 3:**PUSH [F1] for LIST **Step 4:** PUSH [F1] to type LIST and TYPE" **LIST 1 - LIST 2** [→] **LIST 3**" Then [EXE]

Type I error occurs if you reject the null hypothesis, H_0, when it is true and should not be rejected. The probability of a Type I error occurring is α.

Type II error occurs if you do not reject the null hypothesis, H_0, when it is false and should be rejected. The probability of a Type II error occurring is β

6 Steps For Long Answer Questions

1. ***State your hypothesis***
2. ***Identify what test is to be used and why***
3. ***Identify the level of significance***
4. ***Do the calculations***
5. ***Determine the conclusion (reject or not)***
6. ***Concluding statement***

To Find Sample Size

Mean → $n = \frac{z^2\sigma^2}{e^2} = \left(\frac{z\,\sigma}{e}\right)^2$

Proportion → $n = \frac{z^2\,\pi\,(1-\pi)}{e^2}$

To Find Sampling Error

Mean → $e = \frac{\sigma}{n}$

Proportion → $e = z\sqrt{\frac{\pi\,(1-\pi)}{n}}$

Difference between Z and t

Z= std. dev. is said before the sample size (pop)

t= std. dev. is said after the sample size