SAS: k Between Groups ANOVA & Post Hoc Tests

PROC FORMAT:

RUN;

Application: To compare means of a quantitative variable obtained from 2 or more independent groups.

Research Hypothesis: The researcher hypothesized that Coop stores would have the most fish on display, Chain stores would display the least, and Private pet stores would display an intermediate amount.

Froc Format is used to assign labels to data values

H0: for this analysis: The three different types of pet shops have the mean number of fish displayed.

VALUE chainf ← give a name to the format 1 = "chain store" 2 = "privately owned" ← list each data value and the corresponding label 3 = "coop store";RUN: ← specify the library name (path) for the data file LIBNAME stats "C:\stats"; ← call the data set using the library name ← specify the variable and the format for its value labels PROC ANOVA DATA=stats.sasplay1; FORMAT chain chainf.; CLASS chain: ← list independent variable "dependent variable" = "independent variable" MODEL fishnum = chain: MEANS chain ; ← gets group means MEANS chain / LSD ; ← gets the LSD post hoc tests MEANS chain / TUKEY ;

The ANOVA Procedure

Level of	FISHNUM				
CHAIN	N	Mean	Std Dev		
chain store coop store privately owned	5 4 3	17.4000000 35.5000000 19.33333333	5.02991054 4.79583152 4.04145188		

The GLM Procedure

Dependent Variable: FISHNUM number of fish at store

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Node 1	2	812.050000	406.025000	18.01	0.0007
Error	9	202.866667	22.540741		
Corrected Total	11	1014.916667			

The p-value of .0007 means that there is about a .07% chance that this result is a Type I error.

Remember, even if the printout shows it, never report p = .0000, because that would suggest there is no possibility of a Type 1 error. Instead, report "p < .0001"

The ANOVA Procedure

t Tests (LSD) for FISHNUM

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	9
Error Mean Square	22.54074
Critical Value of t	2.26216

Comparisons significant at the 0.05 level are indicated by ***.

Be sure you get the direction of each significant mean difference right!!

Notice that

Private = Chain Coop > Chain Coop > Private

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for FISHNUM

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	9
Error Mean Square	22.54074
Critical Value of Studentized Range	3.94849

Comparisons significant at the 0.05 level are indicated by ***.

CHAIN Conpar i son	Difference Between Means	Simultane Confidence	ous 95% Limits			
coop store- privately ownedcoop store- chain storeprivately owned- coop storeprivately owned- chain storechain store- coop storechain store- privately owned	16.167 18.100 -16.167 1.933 -18.100 -1.933	6.043 9.208 -26.291 -7.747 -26.992 -11.614	26.291 26.992 -6.043 11.614 -9.208 7.747	*** *** ***	ل¥ ا	
Notice that each pairwise comparison is pr	esented twice!					
Be sure you get the direction of each sign	ificant mean dif	ference right!	Private !	e = Cl Coo	nain p > Cha Coop >	in Private

Usually, but not always, results from LSD & HSD analyses agree. When they don't the source of the disagreement is usually that the study is "underpowered" for the HSD. A sample size providing adequate power to reject H0: using the more sensitive LSD may not provide adequate power to reject H0: using the more conservative LSD. This most likely to happen when the sample size is selected based on p<.05, and then the HSD is applied.

Post Hoc "Computators"

SPSS does not provide post hoc analyses for all ANOVA models (e.g., WG designs). Also, there may be occasions when you want to compare means from a study that didn't post analyses, or did them differently than you would have preferred. One additional advantage of using these is that you can provide your readers with the LSD or HSD values that were the basis of your post hoc tests.

http://psych.unl.edu/psycrs/statpage/escomp.exe http://psych.unl.edu/psycrs/statpage/computator_131a.xls



The two Computators will produce slightly different results, and those results might be slightly different from the SPSS results, because they all use slightly different t-table values and Student's t-table values. The specific table (with the applied sample size rounding) can be seen for the xls version if you extend the right side of the spread sheet.

Applying these	LSD	/HSD values to the pairwise com	parisons Chain = 17.40	Private = 19.33	Coop = 35.50
Pair	→	Chain v Private	Chain v Coop	Private v Coop	
Mean Difference	e →	1.93 <	18.10 <	16.17 <	
LSD Result	→	=	<	<	
HSD Result	→	=	<	<	
RH:		The researcher hypothesized that the least, and Private pet stores we	Coop stores would have the most ould display an intermediate amo	st fish on display, Cha ount.	in stores would display
DU: oupport?	→ →	<	< Supported	< Supported	-> Dortiol Support
KIT. Support?	-7	Not supported	Supported	Supponed	

Reporting the Results

The number of fish displayed at each type of store is summarized in Table/Figure 1. There were significant mean differences in the number of fish displayed among the three types of stores, F(2,9) = 18.01, Mse = 22.54, p <.05. Pairwise comparisons using LSD (with a minimum mean difference = 7.59) revealed that, consistent with the research hypothesis, Coop stores displayed more fish than either Private or Chain stores. However, contrary to the research hypothesis, there was no difference between the average number of fish displayed by Chain and Private pet stores.