Name:_____
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Assignment 5
Part I

§ Read the following and answer questions 1-3:

> You are interested in the impact of alcohol on speech production. You want to explore the effect that three 16 ounce glasses of beer, champagne, red wine, and water have on the ability to speak coherently. Forty individuals between the ages of 21 and 29 years old volunteer for your study (giving you 20 people in each group). Each individual is asked to talk about their family after drinking the alcoholic beverage to measure their speech production. The outcome variable for this study was the number of words the individual spoke clearly and coherently when asked about their family.
>
> **Data for Questions 1-3 can be found in the file alcohol.sav**

1. Complete the ANOVA table below for the analysis

Source	SS	df	MS	F
Between	247.4	3	82.467	13.606
Within	218.2	36	6.061	
Total	465.6	39		

2. Interpret the results – what can you conclude from the table above? Be sure to state (in words) the null hypothesis, whether it was rejected or not, and what your conclusions are in terms of the effect of alcohol on speech.

   There is statistically significant evidence to reject the null hypothesis that alcohol does not affect speech production (F= 13.606, df = 3, 36, p value = 0.000).

3. Which of the following would you use to see if there are differences between all possible paired comparisons of beverages?
   a. T-test with Bonferroni correction
   b. Dunnett's test
   c. Fisher's LSD
   d. Tukey's test
   e. Newman-Keuls

4. Perform all paired comparisons using the test chosen above in SPSS. Fill in the following table:

Comparison	Calculated value	Adjusted P-value	Reject H_0?
Beer v Water	-3.8	0.008	Yes
Beer v Wine	3.1	0.038	Yes
Beer v Champ	-1.3	0.643	No
Water v Wine	6.9	0.000	Yes
Water v Champ	2.5	0.124	No
Wine v Champ	-4.4	0.002	Yes

5. Summarize the results.

It appears that there was a statistically significant difference between beer and water, specifically that drinking beer caused more speech production errors than drinking water. Also, there was a statistically sigifnicant difference between beer and wine, specifically that drinking beer caused less speech production errors than drinking wine. There was also a statistically significant difference between water and wine, specifically that drinking water caused less speech production errors than drinking wine. Lastly, there was a statistically significant difference between wine and champagne, specifically that drinking wine caused more speech production errors than drinking champagne. There was not a statistically signficant response difference between drinking beer and champagne or drinking water and champagne in speech production.

§ The following questions are from your textbook (Keppel & Wickens):

1. (Question 6.5 in the textbook) You have run an experiment with four groups and 11 subjects per group. An analysis of variance gives a significant result. You wish to test a comparison ψ, so you calculate its F ratio and obtain F=7.0.
   a. Assume that you planned the experiment to test this contrast. What is the critical value for F at the 0.05 level? Is it significant?
   b. Assume that you noticed this effect when you were looking through the data after completing the study. Test the contrast using Scheffe's method at the 0.05 level.
   c. Explain the discrepancy between the two answers. Why should a result be significant or not depending on when you decide to look at it?

1. a. Since this is a planned contrast, the df_{num}=1, df_{den}=4*(11-1)=40. So From Appendix A.1, $F_{\alpha=0.05(1,40)}$=4.08. The obtained F value is 7.0 which is larger than the critical F value 4.08. So the obtained F value is significant at α=0.05.
   b. $F_{Scheffe} = (a-1)F_{\alpha_{EW}}(df_A, df_{S/A})$
   df_A=4-1=3. $df_{S/A}$=4*(11-1)=40. α_{EW}=0.05. From Appendix A.1, we got $F_{\alpha=0.05(3,40)}$=2.84.

$F_{scheffe}$=(4-1)*2.84=8.52. The obtained F value 7.0 is smaller than the critical F value using Scheffe's method. So the contrast test is not significant.

c. The difference between the two answers lies in the critical F values. For the uncorrected critical F value df_{num}=1, but under Scheffe's method, df_{num}=4-1=3. Sheffe's method takes into account of all the possible contrasts that could have been tested. So the F value is multiplied by (a-1). Thus Scheffe's critical F value is always larger than the uncorrect F value, which makes it harder to reject the null hypothesis.

Part II: SPSS

A researcher wonders if English language learners miss math test questions not because of their lack of mathematics ability but rather because of the language in the test questions. The researcher takes a set of math items and modifies the set in 4 different ways to make 4 different versions of the test.

One test was modified to have simplified sentence structures, one was modified to have all present tense verbs, one has sentences chunked into more manageable sections, and one has had illustrations added to accompany the item context.

The researcher then randomly assigns 100 English language learners so that a group of 20 students takes each of the 5 versions of the test (4 modified versions and 1 unmodified version). He wants to compare their scores on the different versions of the test. The data is located in the file modifications.sav on eLC. Using SPSS, answer the following questions.

1. Record the means and standard deviations for each group. Use the Variable View Values to determine which modification type corresponds to each test number.

Test Number	Modification Type	Mean	Standard Deviation
1	None	13.00	3.16
2	Sentence Structure	17.50	3.76
3	Verb Tense	17.10	2.61
4	Chunking	14.75	3.13
5	Picture	14.50	3.75

2. He planed to compare Sentence Structure and Verb Tense tests groups with the No Modification group, respectively a priori.
   (1) In order to control for family-wise error using the Bonferonni adjustment, what should be your error rate for these contrasts if you want to keep alpha=.05?
   0.05/2 = 0.025

   (2) Record the adjusted p-values for the significantly different groups.
   Only No Modification and Sentence Structure are significantly different (p=0.024).

3. The other researcher is interested in comparing the scores on each type of modified test with the unmodified test. Run the analysis.
   (1) What analysis should you run to do this?
   Dunnett test with No Modification group as reference
   (2) Which groups are significantly different?

Sentence Structure (p-value = 0.004) and Verb Tense (p = 0.014) modification resulted in significantly different test scores from the unmodified test scores.

Dunnett t (2-sided)[a]

					95% Confidence Interval	
(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
SentenceStructure	NoModification	3.50000*	1.04708	.004	.8996	6.1004
VerbTense	NoModification	3.10000*	1.04708	.014	.4996	5.7004
Chunking	NoModification	.75000	1.04708	.884	-1.8504	3.3504
Picture	NoModification	.50000	1.04708	.970	-2.1004	3.1004

4. Now run all possible pairwise comparisons using the Tukey and Scheffe procedures.
   (1) Using a family-wise Type-I error rate of 0.05, record the significant comparison p-values for each significant test.

   From Tukey procedure, No Modification group is significantly different from Sentence Structure modified test (p = 0.01) and the Verb Tense modified test (p = 0.03). The Sentence Structure and Picture modified tests' scores are also significantly different (p = 0.05). For the Scheffe procedure, only the test scores from No Modification and Sentence Structure groups are significantly different (p = 0.03).