WEB PAGE FOR CHAPTER 13

MULTIPLE CHOICE QUESTIONS - SET A.

- 1 Which of the following is a directional research hypothesis, which can be tested using ANOVA? (Variables measured according to scale in brackets. Three bank branches: A, B and C.)
 - (a) There is no difference in the work environment (interval) of the three branches (nominal).
 - (b) There is no relationship among the work environments (interval) of the three branches (nominal).
 - (c) The work environment (interval) in branch C (nominal) is better than the work environment in branch B (nominal).
 - (d) All of the above.
- 2 ANOVA is used when the IV is measured on thescale and the DV is measured on the.....scale.
 - (a) nominal and interval (b) interval and interval
 - (c) ordinal and nominal (d) ratio and normal
 - (d) ratio and normal (e) factor and Tukey
- 3 Use the following three output tables to answer the following questions. The two variables involved are regions (there are 4 of them) and revenue (ie \$ from sales)

Test of homogeneity of variances

Revenue

Levene Statistic	df1	df2	Sig.
.692	3	1484	.557

ANOVA

Revenue

	Sum of squares	df	Mean square	F	Sig.
Between Groups	2764394.050	3	921464.683	.93	0.425
Within groups	1468177818.756	1484	989338.153		
Total	1470942212.806	1487			

Multiple comparisons

Dependent variable: Revenue

Tukey HSD

(I) Territory	(J) Territory	Mean difference (I-J)	Std. error	Sig.	95% Confidence	ce Interval Upper bound
North	South	-\$71.659	\$74.184	.769	-\$262.45	\$119.14
	East	-\$79.769	\$72.594	.690	-\$266.48	\$106.94
	West	-\$117.199	\$71.520	.357	-\$301.14	\$66.74
South	North	\$71.659	\$74.184	.769	-\$119.14	\$262.45
	East	-\$8.110	\$74.514	1.000	-\$199.76	\$183.54
	West	-\$45.540	\$73.467	.926	-\$234.49	\$143.41
East	North	\$79.769	\$72.594	.690	-\$106.94	\$266.48
	South	\$8.110	\$74.514	1.000	-\$183.54	\$199.76
	West	-\$37.430	\$71.862	.954	-\$222.26	\$147.40
West	North	\$117.199	\$71.520	.357	-\$66.74	\$301.14
	South	\$45.540	\$73.467	.926	-\$143.41	\$234.49
	East	\$37.430	\$71.862	.954	-\$147.40	\$222.26

(i) The research or alternative hypothesis could be written as:

- (a) There is no significant relationship between region and revenue.
- (b) There is a significant relationship between region and revenue.
- (c) There is no significant difference in the revenue from the regions.
- (d) There is a significant difference in the revenue from the regions.
- (ii) Levene's test for homogeneity of variance in this case is:
 - (a) significant
 - (b) not significant
 - (c) normally distributed
 - (d) none of the above
- (iii) What does this Levine result imply?
 - (a) all group means are significantly different
 - (b) all group means are the same
 - (c) group variances are similar
 - (d) group variances are significantly different
- (iv) The research hypothesis is at the .05 level because the observed level of significance is

 - (a) supported, greater than .05
 - (b) accepted, less than .05
 - (c) rejected, greater than .05
 - (d) rejected, less than .05
- (v) There is a significant difference in the revenues between which two regions?
 - (a) north and south
 - (b) north and east
 - (c) none
 - (d) west and south
 - (e) west and east

- (vi) Which of the following conclusions would be supported in this case?
 - (a) There is a statistically significant difference in the revenues of the different regions at the .05 level.
 - (b) There is no statistically significant relationship among the revenues of the different regions at the .05 level.
 - (c) There is a statistically significant difference in the revenues of the different regions.
 - (d) There is difference in the revenues of the various regions.
 - (e) The revenues of the four different regions differ significantly at the .05 level.

4 The ANOVA statistic is called the statistic.

- (a) t
- (b) r
- (c) n
- (d) F
- (e) df
- 5 Why do we apply *post hoc* tests in ANOVA?
 - (a) to validate the original finding
 - (b) because we have a two-tail test
 - (c) to determine where the significant difference(s) lie
 - (d) because we have only two groups
- $6 \quad \text{If } F < 1$
 - (a) the null hypothesis is retained
 - (b) the null hypothesis is rejected
 - (c) the alternative hypothesis is retained
 - (d) the alternative hypothesis is supported
- 7 A Tukey test is used:
 - (a) to test the alternative hypothesis
 - (b) to determine between which means significances lies
 - (c) as a non-parametric alternative to ANOVA
 - (d) when no significance differences are found
- 8 If the Levine statistic is not significant we can:
 - (a) abandon the remainder of the test results
 - (b) assume that the variances are heterogeneous
 - (c) assume that the variances are equal
 - (d) assume that the variances of the groups are similar
- 9 Differences between groups that result from our experimental manipulation are:
 - (a) experiment error
 - (b) treatment effects
 - (c) individual differences
 - (d) within group variance
- 10 If you obtain a partial Eta² of .60 how much of the variance in scores on the DV can be accounted for by the IV?
 - (a) 60%
 - (b) 6%
 - (c) 36%
 - (d) 3.6%

- 11 A significant main effect in a factorial ANOVA means:
 - (a) levels of a factor produce significant differences in the IV
 - (b) levels of a factor produce significant differences in the DV
 - (c) the interaction is significant
 - (d) the interaction cannot be significant
- 12 ANCOVA reveals how likely it is that differences between conditions are due to sampling error once means have been adjusted for the relationship between:
 - (a) the dependent variable and the covariate
 - (b) the independent variable and the covariate
 - (c) the dependent variable and the independent variable
 - (d) the Tukey test and group means

SPSS ACTIVITIES. SHARE AND DISCUSS YOUR RESULTS AND THEIR IMPLICATIONS AROUND THE CLASS

Using Chapter 13 Data File A try the following:

- 1 One Way Independent Groups ANOVA: Determine whether there are significant head of household age differences between different house funding methods (mortgage, renting, owning), e.g. do younger persons tend to rent while older ones have a mortgage or own. Use the variables 'age' and 'house funding' and formulate null and alternate hypotheses.
- 2 One Way Independent Groups ANOVA: Determine whether there are significant mean current salary differences between persons using different house funding arrangements. E.g. do those with higher salaries have mortgages or own their homes. Use variables 'current salary' and 'house funding' and formulate null and alternate hypotheses.
- 3 One Way Repeated Measure ANOVA: Determine whether sales for three successive months changed significantly. Use Sales 1, Sales 2 and Sales 3, and establish null and alternate hypotheses for testing.
- 4 Factorial ANOVA: Determine whether differences in starting salary exist for employees grouped by gender and qualification and whether there is an interaction between gender and qualifications in determining starting salary. Establish null and alternate hypotheses.

Using SPSS Chapter 13 Data File B try the following:

- 5 ANCOVA: Determining whether participants smoke or not has a significant effect on baseline anxiety level after partialling out self-esteem. Establish null and alternate hypotheses.
- 6 ANCOVA: Determine if job status has an effect on baseline anxiety if we partial out years experience. Establish null and alternate hypotheses

Using SPSS Chapter 13 Data File A try the following:

- 7 Using a Kruskal-Wallis test determine whether differences in rank of salary now differentiate significantly between persons with different forms of house funding. Establish null and alternate hypotheses.
- 8 Using a Freidman test determine whether significant differences exist across three sales periods. Establish null and alternate hypotheses.

MULTIPLE CHOICE QUESTIONS - SET B

- 1 As the difference between groups increases, the F ratio:
 - (a) decreases
 - (b) increases
 - (c) stays the same
 - (d) cannot tell without calculating it
- 2 Variance between groups is due to:
 - (a) individual differences
 - (b) error
 - (c) random factors beyond researcher's control
 - (d) experimental manipulation
- 3 If experimental manipulation has an effect on the dependent variable this will:
 - (a) decrease the variance between group means
 - (b) decrease the total variance
 - (c) increase the variance between group means
 - (d) increase the variance derived from the variation in scores within group
- 4 The null hypothesis is rejected if:
 - (a) the F ratio is less than 1
 - (b) the group means differ only as a function of chance
 - (c) MSB divided by MSW is zero
 - (d) none of the above
- 5 A factorial ANOVA is one that has more than one independent variable.
 - (a) true
 - (b) false
 - (c) sometimes
 - (d) depends on the design of the investigation
- 6 \sqrt{F} equals t
 - (a) true
 - (b) false
 - (c) sometimes
 - (d) depends on whether a one- or two-tailed test is used
- 7 Post hoc comparisons of means are always used after the ANOVA test.
 - (a) true
 - (b) false if significant differences have been found
 - (c) only when there are three or more groups
 - (d) depends on finding no significant differences
 - When F = 1, the mean variance in the numerator is:
 - (a) 0

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- (b) the same as the mean variance in the denominator
- (c) 1
- (d) .05
- 9 What happens to the value of the F ratio if the differences between treatments is

increased?

- (a) The F ratio will increase(b) The F ratio will decrease
- (c) The F ratio will remain the same
- (d) Any change depends on df

- 10 What value is expected on the average for the F ratio if the null hypothesis is true?
 - (a) 0
 - (b) 1
 - (c) depends on df
 - (d) impossible to say
- 11 What sources contribute to within treatments and between treatments variability for a repeated measures ANOVA design?
 - (a) effect of independent variable and experimental error
 - (b) experimental error
 - (c) individual differences and the effect of the independent variable
 - (d) the effect of the independent variable, individual differences and error
- 12 If F(2,12) = 5.00 how many levels of the IV were there in a factorial ANOVA?
 - (a) 2
 - (b) 12
 - (c) 5
 - (d) 3
- 13 As the variation between groups becomes larger to the within group variation, does F become larger or smaller?
 - (a) smaller
 - (b) larger
 - (c) depends on df
 - (d) has no effect
- 14 It is impossible to have an interaction unless main effects are also present:
 - (a) true
 - (b) false
 - (c) depends on N
 - (d) depends on the F level reached
- 15 The Kruskall-Wallis is:
 - (a) a non-parametric alternative for the Mann-Whitney test
 - (b) a parametric alternative to ANOVA
 - (c) a parametric alternative to Wilcoxon
 - (d) a non-parametric alternative to the between groups ANOVA
- 16 ANCOVA
 - (a) controls for the effect of the IV on the DV
 - (b) controls for the effect of the DV on the IV
 - (c) is a non-parametric version of ANOVA
 - (d) ensures the effect of the IV on the DV is not masked by another variable
- 17 When conducting a pretest-post-test study researchers wish to
 - (a) partial out the DV
 - (b) partial out the effect of the pretest
 - (c) reduce the correlation between the IV and DV
 - (d) reduce the correlation between the pretest and post-test

ADDITIONAL QUESTIONS

- 1 What does the denominator measure in the F ratio?
- 2 With three treatment conditions is a *post hoc* test necessary when the null hypothesis is rejected?

- 3 A researcher reports an F ratio with df = 2,30 for a one-way analysis. How many treatment conditions and how many subjects were there?
- 4 Complete the following table:

Variance	SS	df	MS	F
Between groups	2.6	a	1.3	b
Within groups	c	27	d	
Total	170	e		

- 5 How does the F ratio for the repeated measures ANOVA differ from that for the independent measures?
- 6 A factorial ANOVA is conducted to ascertain the level of anxiety of the learner and the meaningfulness of the material on the speed of learning lists of words. Between which two variables might the interaction effect be shown?
- 7 A researcher using a one-way independent measures design to compare different leadership styles on job satisfaction reports an F ratio of 3.87 with df 3,28.
 - (a) How many leadership styles were compared?
 - (b) How many employees participated in the total experiment?
 - (c) What is the null hypothesis?
 - (d) If a significant result occurs will a *post hoc* test be needed?

CLASS ACTIVITIES

- 1. Obtain some interval data from other students in your college/university relating to their scores on a variable that can produce interval data such as shoe size or measured heights, etc. Test the hypothesis with ANOVA that there is a gender difference in this variable. What other independent variables could you also test for differences? You may have age differences in heights or ethnic group differences in foot size that you could work with, for example. You could undertake a factorial ANOVA with another variable involved.
- 2 Below is some printout of a factorial ANOVA. The grouping variables are 'Trade Union membership' and 'whether in work or not' in relation to 'age' as the DV. In groups, peruse the printout and write up a short explanation of what the tables show and their implications. Make a graph of the interactions to help with the explanation.

Univariate Analysis of Variance

Between-Subjects Factors						
		Value Label	N			
TU membership	1.00	yes	29			
or not	2.00	no	94			
in work or not	1.00	Currently				
		working	63			
	2.00	currently				
		unemployed	29			
	3.00	currently unemployed but not	21			
		looking for work				
	4.00	retired	10			

Descriptive Statistics

Dependent Variable: age

TU membership or not	in work or not	Mean	Std. Deviation	Ν
yes	currently working	26.8824	3.96677	17
	currently unemployed	31.0000	12.37509	8
	currently unemployed but not looking for work	43.0000	.00000	4
	Total	30.2414	8.80607	29
no	currently working	43.6739	11.74555	46
	currently unemployed	34.6667	4.66190	21
	currently unemployed but not looking for work	39.9412	8.07365	17
	retired	60.0000	6.32456	10
	Total	42.7234	11.62441	94
Total	currently working	39.1429	12.67441	63
	currently unemployed	33.6552	7.52271	29
	currently unemployed but not looking for work	40.5238	7.32543	21
	retired	60.0000	6.32456	10
	Total	39.7805	12.21094	123

Levene's Test of Equality of Error Variances

Dependent Variable: age

F	df1	df2	Sig.
7.960	6	116	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups. a. Design: Intercept+TUMEMB+WORKING+TUMEMB

* WORKING

Dependent Variable: age								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observe d Power ^a
Corrected Model	8821.592 ^b	6	1470.265	18.203	.000	.485	109.217	1.000
Intercept	102042.969	1	102042.969	1263.355	.000	.916	1263.355	1.000
TUMEMB	538.677	1	538.677	6.669	.011	.054	6.669	.726
WORKING	4424.753	3	1474.918	18.260	.000	.321	54.781	1.000
TUMEMB*WOR KING	1355.786	2	677.893	8.393	.000	.126	16.785	.960
Error	9369.481	11 6	80.771					
Total	212837.000	12 3						
Corrected Total	18191.073	12 2						

^{a.} Computed using alpha = .05

^b. R Squared = .485 (Adjusted R Squared = .458)

Multiple Comparisons

Dependent Variable: age

Tukey HSD

		Mean			95% Co Inte	nfidence rval
(I) in month on not	(I) in more on not	Difference	Std.	C:-	Lower	Upper
(1) IN WORK OF NOU	(J) IN WORK OF NOL	(I-J)	Error	51g.	Bound	Bound
currently working	currently unemployed	5.4877*	2.01676	.037	.2307	10.7447
	currently unemployed but	-1.3810	2.26458	.929	-7.2840	4.5221
	not looking for work					
	retired	-20.8571*	3.05928	.000	-28.8317	-12.8826
currently unemployed	currently working	-5.4877*	2.01676	.037	-10.7447	2307
	currently unemployed but	-6.8686*	2.57517	.043	-13.5812	1560
	not looking for work					
	retired	-26.3448*	3.29581	.000	-34.9359	-17.7538
currently unemployed but	currently working	1.3810	2.26458	.929	-4.5221	7.2840
not looking for work	currently unemployed	6.8686*	2.57517	.043	.1560	13.5812
	retired	-19.4762*	3.45303	.000	-28.4771	-10.4753
retired	currently working	20.8571*	3.05928	.000	12.8826	28.8317
	currently unemployed	26.3448*	3.29581	.000	17.7538	34.9359
	currently unemployed but	19.4762*	3.45303	.000	10.4753	28.4771
	not looking for work					

Based on observed means.

*The mean difference is significant at the .05 level.

ANSWERS TO MULTIPLE CHOICE QUESTIONS - SET A

1 (c), 2 (a), 3 (i) d, (ii) b, (iii) c, (iv) c, (v) c, (vi) b, 4 (d), 5 (c), 6 (a), 7 (b), 8 (d), 9 (b), 10 (a), 11 (b). 12 (a)

ANSWERS TO MULTIPLE CHOICE QUESTIONS - SET B

ANSWERS TO ADDITIONAL QUESTIONS

1 error or variance due to chance

2 no

- 3 3 conditions and 33 subjects
- 4 a = 2; b = 0.209; c = 167.4; d = 6.2; e = 29
- 5 Individual differences do not figure in the ratio for repeated measures ANOVA whereas it contributes to both numerator and denominator in the independents groups ANOVA.
- 6 anxiety and meaningfulness
- 7 a = 4; b = 32; c = that there is no significant difference between job satisfaction and leadership styles; d = yes