Name____ Section_________________________

Psychology 318 Final Exam
June 6, 2006

Instructions

1. Use a pencil, not a pen.
2. Put your name on each page where indicated, and in addition, put your section on this page.
3. Exams will be due at 10:20!
4. If you find yourself having difficulty with some problem, go on to the rest of the problems, and return to the troublemaker if you have time at the end of the exam.
5. Leave your answers as reduced fractions or decimals to three decimal places.
6. **CIRCLE ALL ANSWERS: You will lose credit if an answer is not circled!!**
7. Check to make sure that you have all questions (see grading below).
8. **SHOW ALL YOUR WORK: An answer that appears from nowhere will receive no credit!!**
9. Use the .05 α level unless told otherwise.
10. Don't Panic!
11. Good luck!

Grading

Problem	Points	Grader
1a-f	26	Becky
2a-c	12	Bailey
3a-b	15	Vicki
4a-c	16	Greg
4d-h	21	Serena
5	6	Katie
6	4	Ren

Name____ Section__________________________

1. Consider a within-subjects design with J=5 conditions, K=10 subjects, and n=20 observations per subject per condition. Below is part of the ANOVA table.

Source	df	SS	MS	Obtained F	Criterion F
Between		200			
Conditions		175			
Subjects		6			
Interaction					
Within			0.300		
Total					

a) Fill in all missing degrees of freedom, sums of squares, and mean squares. Put them in the table. (7 points)

b) Compute the obtained F and determine the criterion F for the effect of conditions. Put them in the table. (4 points)

c) Compute the "within-subjects" 95% confidence interval appropriate for putting around the mean of each condition. NOTE: You need compute only one confidence interval. (5 points)

Name____ Section________________________

Problem 1 (continued)

d) Suppose that the investigator becomes suspicious that the experimenter running the experiment has, lazily, just run one subject 10 times in the experiment (each time collecting 20 observations) rather than running 10 different subjects. What *two* null hypotheses would be implied to be true if this were the case? Test these two null hypotheses. (2 points)

Problem 1 (continued)

e) Suppose that the investigator discovered that an error had been made: Whereas the experiment was supposed to have been run as a within-subjects design, it had actually been run as a between-subjects design. There were n=10 subjects *in each of the J=5 conditions*. Each subject still had participated 20 times in the condition to which he or she had been assigned. The sums of squares above came about, as indicated above, from incorrectly treating the design as a within-subjects design.

Now treating the design as a between-subjects design, is there a statistically significant effect of conditions? Make up a new ANOVA table. (3 points)

f) Suppose that you wanted to compute a confidence interval for a single subject in a given condition. Assume homogeneity of variance wherever possible. What would this confidence interval be? Be sure to indicate the relevant degrees of freedom (2 points)

HINT: It doesn't matter for this part whether you consider the data to come from a within-subjects design or a between-subjects design.

Name____ Section_________________________

2. An exobiologist is studying Venusians, and in particular is investigating the relation between Venusian verbal ability (X measured by the Venusian verbal ability test or VVAT) and income (Y, measured in Venes, which is the Venusian currency unit).

The VVAT has a population mean, $\mu_X = 100$ and a standard deviation, $\sigma_X = 15$.

Venusian income has a population mean, $\mu_Y = 40$ Venes and a standard deviation, $\sigma_Y = 10$ Venes.

The Pearson r relating VVAT and Income was found to be r = -.6. (It is odd that VVAT and income are negatively correlated, but that turns out to be true for Venusians).

a) Suppose that you are predicting Income from VVAT. What would be the variance of the predicted Income scores? (6 points)

b) Suppose that you are predicting VVAT from Income. What would be the variance of the predicted VVAT scores? (2 points)

c) Consider all Venusians with an income of 52 Venes. What would be the mean VVAT score for these individuals? (4 points)

Name____ Section_________________________

3. Roxy's Deli is testing two kinds of mustard on their pastrami sandwiches, trying to figure out which tastes better. Three groups of subjects are randomly assigned to three conditions. The groups differ in terms of what kind of mustard is put on their sandwiches. Group 1, a control group, gets no mustard. Group 2 gets French's standard yellow mustard. Group 3 gets Grey Poupon Dijon mustard. Each subject in each group rates the quality of their pastrami sandwich after eating it on a scale ranging from 1 ("awful") to 5 ("great").

Originally a total of N = 48 subjects was obtained, and n = 16 were randomly assigned to each of the three conditions. Unfortunately, numerous subjects left the experiment without filling in their ratings. Data for the subjects (mean rating) are summarized in the table below. Recall that "S_j^2" is the sample variance of Group j.

Statistic	Group 1: Control	Group 2: French's Yellow	Group 3: Grey Poupon
n_j		1	15
M_j			4.50
Σx_j^2	100.00	2.25	350.00
T_j			
est σ_j^2			
df_j	9		
SS_j			
S_j^2			
$est_j\ \sigma_M$			
$est_j\ \sigma$			
T_j^2/n_j	62.50		

a) Fill in the information in the blank cells of the table. If it is not mathematically possible to compute some number, enter C/C (for "can't compute") in the cell. (.5 points per cell or 12.5 points in all)
NOTE: If there are cells you can't fill in, a TA will sell them to you for half a point/cell.

b) If you've done this problem right, there should be some cells whose values you can't compute for Group 2. Explain why you can't compute these values. Be brief! (2.5 points)

Name____ Section__________________________

4. Roxy's figures out how to get its subjects to behave and reruns the experiment from Question 3. Below are all the relevant data, in the same kind of table you filled in above. The far-right column is provided for your convenience, should you wish to compute any row sums.

Statistic	Group 1: Control	Group 2: French's Yellow	Group 3: Grey Poupon	
n	16	16	16	
M_j	2.00	1.20	4.70	
Σx_j^2	300.00	160.00	450.00	
T_j	32.00	19.20	75.20	
est σ_j^2	15.73	9.13	6.44	
df	15	15	15	
SS_j	236.00	136.96	96.56	
S_j^2	14.75	8.56	6.04	
$\text{est}_j\ \sigma_M$	0.99	0.76	0.63	
$\text{est}_j\ \sigma$	3.97	3.02	2.54	
T_j^2/n	64.00	23.04	353.44	

a) Compute SSB and SSW. (8 points)

b) Carry out a standard ANOVA. (5 points)

<u>Source</u> <u>df</u> <u>SS</u> <u>MS</u> <u>Obt F</u> <u>Crit F</u>

Problem 4 (continued)

c) For this part (c) only, suppose that the population variance were *known* to be 25. Re-do the F-test from the ANOVA of Part (b). Is the F significant? *Be sure to provide the criterion F*. (3 points)

d) Parts d-f involve planned comparisons. Make up *two independent hypotheses* about the relations among the three groups. Note that we have started you off by indicating the first weight (0) for your first hypothesis in the table below. State verbally what your hypotheses mean. List the remaining weights corresponding to your hypotheses in the table. For each hypothesis, the weights must consist of integers. (5 points)

	Group 1: Control	Group 2: French's Yellow	Group 3: Grey Poupon
H1	$W_1 = 0$	$W_2 =$	$W_3 =$
H2	$W_1 =$	$W_2 =$	$W_3 =$

Meaning of H1:

Meaning of H2:

e) Compute sums of squares and mean squares corresponding to your hypotheses and to the residual. If there is anything you can't compute, indicate what it is and why you can't compute it. Briefly comment, if you can, about the value of the residual and why it is what it is. (6 points)

Name____ Section_________________________

Problem 4 (continued)

f) What are the Pearson r^2's between the means and each of your two sets of weights? (4 points)

g) Carry out a 2-tailed t-test between the Groups 2 and 3. ***Use an α-level of .01***. Assume homogeneity of variance. (3 points)

h) Assume that the variance is the same for Groups 2 and 3, but that this variance is not necessarily the same as the variance for Group 1. Compute the 95% confidence interval around (M_3 - M_2). (3 points)

Name____ Section_________________________

5. I have asserted that two hypotheses (i.e., two sets of weights, $W1_j$ and $W2_j$) are independent if the correlation between them is zero. Prove that this correlation is zero if the sum of the $W1_j$ and $W2_j$ cross-products is zero. (HINT: This is an easy proof. Don't panic. Start by considering what's sufficient for r to equal zero). (6 points)

6) Suppose you run a between-subjects experiment with one independent variable. List (very briefly) four *and only four* major analysis techniques that you could carry out in quest of trying to figure out what the data are telling you about whatever question that they were meant to address. (4 points)