Psychology 610 Fall 2003
Final Exam - December 18, 2003 Prof. Moore

ID# _____
Do not put your name on this exam.

SHOW YOUR WORK!!

1. This series of questions is about design and statistical problems that can occur in the real world. We proceed even though the world isn't perfect, but it helps to think ahead.

Professor Illustrator is interested in the development of infants' understanding of pictures. Assume that she presents 9-month-old infants with a picture book containing a color photograph, a black and white photograph, a color drawing, and a black and white drawing of a common object. The dependent variable is the number of times the infant grasps at and tries to "pluck" the object off the page during a 30-second viewing period of each page. For now assume that each infant views the same object in all 4 representations. Professor Illustrator needs some advice about designing the study in order to find out how infants' manual investigations are affected by the degree to which a picture resembles an actual object. (Note: this example is "fictionalized" from work by DeLoache and colleagues, Current Directions in Psychology, 2003.)

a. (10 points) What are the statistical pros and cons of using within-subject design in this example?

b. (5 points) What statistical assumption of ANOVA might not hold for the dependent variable (the number of attempts to pluck the object off the page) regardless of whether the design is within- or between-subject, and how serious is that violation for the $\forall$–levels of the statistical tests?

c. (10 points) Comment statistically on the pros and cons of whether Professor Illustrator should use illustrations of several different objects in this study in order to increase its generalizability.

d. (10 points) If Professor Illustrator decides to use a within-subject design for the four types of illustrations, what are two ways of dealing with the possibility that there would be order effects (or carry-over effects), assuming that the illustrations all portray the same object? What are the pros and cons of the two approaches?

e. (5 points) Suppose that Professor Illustrator finds that, on average, color illustrations or pictures elicit more "attempts to pluck" from 9-month-old infants than do black and white illustrations. She follows up the experiment with a second experiment that examines 19-month-old infants in the same task. She finds that while color illustrations elicit slightly more "plucking" from 19-month-old infants than do black and white illustrations, the difference is not statistically significant. She concludes that color affects the behavior of 9-month-olds but not 19-month-olds. Is she justified in drawing this conclusion? Why or why not?

f. (5 points) Professor Illustrator conducts an additional experiment with fifteen 9-month-old infants, fifteen 15-month-old infants, and fifteen 19-month-old infants as the participants. After starting to analyze the data, she notices that only ten of the fifteen 19-month-old infants completed the experimental session. She asks you for advice on what she should do. What is your advice?

g. (30 points) Assume that the variables of photograph versus drawing and color versus black and white were manipulated within-subjects, but that age of child (9, 15, and 19 months) was between-subjects. Lay out the source table for the anova including sources, df, and bracket expressions. Also indicate the correct error terms for each testable effect. Assume that each age group has 15 infants in it.

h. (10 points) Now suppose that after the experiment is run, Professor Illustrator decides also to include the gender of the infant in the analysis. Assume for this question that all infants who started the experiment completed it, but that there were 8 female 9-month-olds, 6 female 15-month-olds, and 11 female 19-month-olds out of the fifteen infants in each age group. Professor Illustrator has found a significant Age x Gender interaction and a significant effect of Gender. What are two important considerations for Professor Illustrator in reporting the statistical results and means?

2. (10 points) Explain the basic idea of how the F-ratio can be used to test the null hypothesis that the population means are equal.

3. (10 points) You are reviewing a study that examines the effect of housing situation on the social adjustment of international students who have come to the U.S. to go to college. Half of the participants in the study were assigned a dorm room with someone from their native country and half of the participants in the study were assigned to a dorm room with an American. The experiment included students from China, France, Germany, and Russia. The dependent measure was score on a questionnaire measuring personal happiness at the end of the first semester in the U.S. In the results section of the manuscript, the researcher states the following: "Post-hoc tests using Scheffe's method revealed no significant differences due to country of origin. Therefore, analyses were performed on the data pooled over the four countries." As a reviewer, how would you respond to this justification for pooling?

4. Here's a "Breakfast Question". School lunch programs exist because it is generally believed that students who eat breakfast perform better than students who don't eat breakfast. Below are some hypothetical data for a 3 (factor A) x 3 (factor B) x 2 (factor C) mixed design, with repeated measures on factor B. The dependent variable is teacher rating of the alertness of each child at three points during the morning. Factor B is the time of the morning that the ratings are made. Assume that factor A is type of breakfast eaten. Condition A1 is bagel, condition A2 is fruit, and condition A3 is nothing.

			B1	B2	B3
A1	C1	Participant 1	2	4	6
		Participant 2	2	5	7
	C2	Participant 3	3	6	8
		Participant 4	1	4	7
A2	C1	Participant 5	3	4	6
		Participant 6	5	7	8
	C2	Participant 7	2	4	9
		Participant 8	1	3	5
A3	C1	Participant 9	2	1	1
		Participant 10	3	2	4
	C2	Participant 11	2	3	2
		Participant 12	3	3	2

a. (15 points) Compute the F-value for the interaction contrast that tests whether the linear relationship between factor B and the dependent measure differs as a function of eating something for breakfast versus eating nothing for breakfast (HINT: Stop and think so you calculate only what you need.)

5. (5 points each) To the left is a set of two-way graphs, each labelled with a letter. Put the letter or letters of the graphs with the descriptions they match. Provide a brief description of why you put a given letter with a given description (a letter may be used more than once or not at all).

-- Would have a A_{LINEAR} x B_{LINEAR} interaction

-- Would have an $A_{QUADRATIC}$ x B

-- Would not have a main effect of B

6. Here is a set of cell <u>totals</u> for a two-factor between-subjects design with n = 5.

	A1	A2	A3	A4
B1	10	50	100	90
B2	10	30	60	50
B3	10	10	20	10

a. (5 points) The totals for A1B1, A1B2, and A1B3 are all equal. Therefore the SS for

_____ would be zero.

b. (15 points) Use the Fisher-Hayter method to test the difference between A_2 and A_3. Assume $MS_{S/AB} = 4.0$

7. (5 points) Name and describe something covered in the course that is not on this exam.