

Psychology 318 Exam #3
May 8, 2004

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 9:20!
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

<u>Problem</u>	<u>Points</u>	<u>Grader</u>
1a-b	40	Greg
1c-d	20	Ren
2a-d	40	Becky
TOTAL	100	

1. You'll recall from Exam 2 that Daryl the criminologist was studying prison terms for four ethnic groups: white females (WF), white males (WM), Hispanic males (HM), and African-American males (AAM).

You may also recall a second study on sentencing, in which a second question was posed: Does sentence length depend on the kind of crime committed as well as ethnic group? To answer this question, the same four ethnic groups (WF, WM, HM, AAM) are studied: Sentence length is recorded for each individual from within each group for each of three crimes: unarmed robbery, armed robbery, and first-degree murder. There are $n = 20$ individuals in each group (n is the same for all 12 groups).

Below are the same summarized data (cell means, plus various totals) that you saw in Exam 2.

	WF	WM	HM	AAM	T_{Rk}
Unarmed Robbery	9.5	9.9	14.2	11.8	908
Armed robbery	11.2	7.6	13.2	16.9	978
Murder	12.9	16.7	13.3	16.5	1,188
T_{Cj}	672	684	814	904	$T = 3,074$

Note: $\sum \sum T_{jk}^2 = 826,652$

$\sum T_{Cj}^2 = 2,399,252$

$\sum T_{Rk}^2 = 3,192,292$

Assume: $\sum \sum \sum x_{ijk}^2 = 42,472.60$

(CAUTION! These sums haven't been divided by anything)

a) Carry out a two-way ANOVA on these data. Make sure to put everything in a neat and tidy ANOVA table. Make sure to include criterion F's. (30 points)

Problem 1 (continued)

b) Determine whether there is a statistically significant effect of ethnic group **for the Murder category only**. Continue to assume homogeneity of variance everywhere. HINT: It is useful in solving this problem to know that $\sum T_j^2 = 357,776$. (10 points)

c) Continue to assume homogeneity of variance everywhere. What is the grand mean, and the 95% confidence interval around the grand mean? (10 points)

Problem 1 (continued)

d) Assume that homogeneity of variance holds within each row, but not necessarily across rows (for example, assume that all four “Unarmed Robbery” cells have the same population variance but that this variance isn’t the same as it is for the “Armed Robbery” and “Murder” cells).

Compute a 95% confidence interval around M_{11} . Be sure to indicate relevant degrees of freedom.

NOTE: For this question, assume that $\sum \sum x_{ij}^2 = 11,000$, and note that $\sum T_{j1}^2 = 211,656$. (10 points)

2. Starbucks is testing ways of speeding up the time it takes for lattés to be made and delivered to the customer. In particular, Starbucks believes that different music in its stores may influence delivery time, and is trying four different kinds of music: No music (i.e., silence), Classical Music, Jazz, and Reggae.

A random sample of 10 Starbucks stores, drawn from around the world, is chosen for participation in an experiment. At one time or another, each of the 10 stores has a month of each of the four music types, and latté delivery times are assessed.

So in summary, this is a within-store design involving 4 Music conditions and 10 stores, with one observation for each store in each Music condition.

The mean (delivery time in seconds) for each of the music environments are as follows:

Silence	Classical	Jazz	Reggae	
47.1	47.6	48.4	48.1	M_j

Note: $T = 1,912$
 $\sum \sum T_{jk}^2 = 95,484$
 $\sum T_{Cj}^2 = 914,034$
 $\sum T_{Rk}^2 = 381,788$

(CAUTION! These sums haven't been divided by anything)

a) Compute n_C , n_R , and N , plus all relevant sums of squares *including total sum of squares*. Indicate (*in an ANOVA table*) these sums of squares and their associated degrees of freedom. Perform the appropriate ANOVA. Be sure to show the criterion F or Fs. (20 points)

b) Compute the appropriate “within-subjects” 95% confidence interval that goes around each column mean—the confidence interval suitable for making inferences about *patterns* of population means. (10 points).

c) Compute the “genuine” 95% confidence interval, appropriate for assessing what the actual population means are. (5 points)

d) Suppose you discovered that, in fact, the score for each Music condition in each of the Starbucks Stores was a mean of data gathered on each of 20 weekdays. In other words, each of the 10 stores participated in each of the four Music conditions, and there were 20 scores for each store in each condition. Re-do your ANOVA table from Part (a). (5 points)