## Psychology 318 Final Exam

## June 9, 2010

### 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. Don't Panic!

10. Assume homogeneity of variance unless told otherwise.

11. Good luck!

### Grading

Problem Points Grader

1a-e 30 Chris

1f-i 10 Leanna

2 10 Alec

3 5 Alec

4a-c 30 Jianli

5a-c 15 Yigu

TOTAL /100

1. The Serenity Drug Company has invented a drug called “Compose” which is designed to promote calmness. Compose comes in three versions, 1, 2, and 3). Serenity’s scientists carry out an experiment to assess whether and how Compose takers’ calmness differs for the three versions. Calmness is measured by calmness ratings on a scale ranging from 1 (not calm at all) to 5 (complete bliss).

In addition to the three groups of subjects that are administered the three Compose versions, there is a Control group to which only a placebo is given.

Partial summary data are provided below. The means, Mj, are in calmness ratings.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Group |  |  |
| Statistic | Version 1 | Version 2 | Version 3 | Control | Sum | Interpretation of sum |
| nj | 20 |  |  | 10 |  |  |
| Tj | 56.00 | 45.90 | 3.00 | 12.00 | 116.9 | T |
| Tj2/nj | 156.80 |  |  | 14.40 |  |  |
| Mj | 2.80 | 2.70 | 3.00 | 1.20 | 306.12 | ij2 |
| ij2 | 156.99 | 125.37 |  | 14.76 |  |  |
| SSj | 0.19 |  |  | 0.36 |  |  |
| dfj | 19 |  |  | 9 |  |  |
| est j | 0.10 |  |  | 0.20 |  |  |
| est j2 | 0.01 |  |  | 0.04 |  |  |

a) Fill in the remaining table entries as follows.

Fill in all missing cells in the Version 2 and Version 3 columns. For anything that cannot be computed, enter an “X” in the appropriate cell.

In the “Sums” column fill in any sum that can be used in constructing an ANOVA table. Any sum that cannot be used in constructing an ANOVA table should be marked “N/A”.

In the “Interpretation of sum” column, provide the symbol or expression that corresponds to all sums that you have computed in the corresponding “Sums” column. Alongside any sum that you have marked “N/A”, write “None” in the “Interpretation of sum” column.

To get you started, note that we have filled in the “Sum” and “Interpretation of sum” cells for the “Tj" row and the ij2 row.

(15 points)Problem 1 continues

b) Is there an effect of the four conditions on calmness ratings? Carry out a standard ANOVA on these data and put the results in a standard ANOVA table. Include a “Total” row in your table. (5 points)

c) Assume homogeneity of variance. Compute the 80% confidence interval around the Version-1 mean. (4 points)

Problem 1 continues

d) Do *not* assume homogeneity of variance. Compute the 80% confidence interval around the mean for Version 1. (4 points)

e) Suppose that you had done the study only for the Control and for Version 1 groups (i.e., suppose that the data from the Versions 2 and 3 groups didn’t exist). Test whether the Control and for Version 1 means are significantly *different*. (2 points)

Problem 1 continues

f) Assuming again that data from Versions 2 and 3 didn’t exist, compute a 95% confidence interval around the difference between the Control and Version-1 means. Include upper and lower limits of your confidence interval. (3 points)

g) Assume again the existence of all four groups. Assume that the population variance, 2, is *known* to be .04. Compute the 80% confidence interval around the Version-3 mean (2 points)

h) Do the *variance estimates* (estj2) for the Version 1 and Control conditions differ significantly? (3 points)

i) What is 2 for this experiment? (2 points)

2) Consider a 3x2 factorial design with n = 2 observations per cell. Assume that T, the grand total, is 48. Make up data (i.e., 12 Xijs’s) that imply: SSC = 0, but all other sums of squares are greater than zero. Note that you are constrained in the sense that T = 48. Enter your numbers in the table provided. HINT: Make up column and row totals first and then work from there. (10 points)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Factor 1 |  |
|  |  | Level 1 | Level 2 | Level 3 |  |
| Factor 2 | Level 1 |  |  |  |  |
| Level 2 |  |  |  |  |
|  |  |  |  |  | T = 48 |

3. Assume an experiment with a 2 x 2 design. Assume further that,

SSB = 500

SSC = 200

SSI = 100

Draw a *rough* representation of what the four means would look like on the graph below. Be sure to label everything that is necessary to make your graph clear and unambiguous. (5 points)

 4. An experiment is performed to evaluate J = 3 kinds of year-long statistics teaching methods on learning of statistics. The experiment is carried out in K = 10 universities. Separate groups of n = 20 randomly selected sophomores participate in each of the 3 teaching methods in each of the 10 universities (thus 30 separate groups, each group containing 20 students). At the end of the year, all participating students’ scores on a standard statistics assessment test are measured. The score on this test ranges from 0-10.

The condition means and totals are as follows. For your convenience, we have also computed the grand total, T.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Method I | Method II | Method III |  |  |
| MCj = | 6.80 | 8.40 | 3.40 |  |  |
| TCj = | 1,360 | 1,680 | 680 | 3,720 | = T |

Assume the following:

SST2jk = 753,440

ST2Rk = 1,503,840

SSSx2ijk = 66,172

For your convenience, note that,

ST2Cj = 5,134,400

CAUTION: These sums haven’t been divided by anything

a) What is sum of squares total (SST) in this experiment? On how many degrees of freedom is it based? DO NOT compute SST from SSB and SSW in this question; rather compute it directly from the data; ditto with the associated degrees of freedom. Be sure to show your work. (5 points)

b) Consider "Universities" to be a random effect. Carry out a standard ANOVA, putting your results in an ANOVA table. Put your ANOVA results in an ANOVA table. Compute the “within-universities” confidence interval appropriate for placing around each ***Teaching Method mean***. (NOTE: You need compute only one confidence interval). (15 points)

c) Consider “Universities” to be a fixed effect. Carry out a standard ANOVA, putting your results in an ANOVA table. Compute the confidence interval appropriate for placing around ***each cell mean***. (NOTE: You need compute only one confidence interval). (10 points)

5. The correlation between men’s weights in pounds (X) and heights in inches (Y) is r = 0.70. The regression line relating Y' to X is:

Y' = 0.6X + 0.00

a) Suppose that men's height (Y) is distributed with a standard deviation, sY of 2.2 inches. What would be sY', the standard deviation of the distribution of Y' scores (i.e., the heights that are predictable from weight)? (6 points)

b) Suppose that men's height (Y) is distributed with a mean, m, of 50 inches and a standard deviation, sY of 2.2 inches. Consider all men whose weight is 1.5 standard deviations above the mean. What would you predict the mean height of these men to be? (5 points)

c) Suppose that height were measured in feet rather than in inches. What would be the Pearson r and the values of b and a in the regression equation? (4 points)