## Psychology 318 Exam #3

## May 5, 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-d 45 Yigu

1e-g 25 Jianli

2a-d 30 Alec

TOTAL /100

1. Here is the study from Exam 2, question 3. Recall that an exercise physiologist is investigating the joint effects of age and vitamin consumption on ability to perform sit-ups. A 4 (age) x 3 (drug dosage) experiment is run. There are n=6 subjects in each cell. The levels of each factor along with the data (mean sit-ups per minute) are provided below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **Age** | | | |  |
|  |  | Teens | 20's | 40's | 60's | Means |
|  | None | 20 | 30 | 25 | 15 | 22.50 |
|  | 500 mg | 22 | 35 | 25 | 25 | 26.75 |
|  | 2000 mg | 29 | 31 | 30 | 30 | 30.00 |
|  | Means | 23.667 | 32.000 | 26.667 | 23.333 | 26.42 = M |

Note that: T2jk = 313,596 NOTE!! These sums of squared totals

T2Cj = 920,052 haven't yet been divided by anything!

T2Rk = 1,222,164

T2 = 3,617,604

Assume that: x2ijk = 56,106

a) Compute all relevant sums of squares that would be included in a two-way ANOVA (15 points)

b) Carry out the appropriate ANOVA on these data. Put your results in an ANOVA table. (10 points)

c) What would be the 95% confidence interval for the *difference* between M11 and M22? (10 points)

d) Is there a statistically significant effect of drug dosage for people in their 60’s? Show your results in an ANOVA table. Reminder: you should be assuming homogeneity of variance. (10 points)

e) Assume homogeneity of variance holds within each column. That is for each age group the population variance is the same for the three drug dosages. However, homogeneity of variance does *not* necessarily hold between columns. For example, the population variance for teens isn't necessarily the same as the population variance for people in their 60’s. Is there a statistically significant effect of drug dosage for people in their 60’s? NOTE: Assume that x2i4k = 12,000. Show your results in an ANOVA table. (5 points)

f) Make the same homogeneity of variance assumption as in Part e. What is the 95% confidence interval around M42? (5 points)

g) Go back to assuming homogeneity of variance across all cells. Suppose that 2 were known to be 20.000. Re-do the ANOVA from Part a, and re-compute the confidence interval for the difference between M11 and M22 from Part c. (15 points)

2. Each of 20 runners runs 4 ten-kilometer races—one race at each of 4 altitudes: sea level, 500 feet, 2,000 feet, and 5,000 feet. Summarized data are shown in the table below: times to run the races at each of the four altitudes, averaged over the 20 runners. (Extra space has been left for calculations).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Race altitude (feet) | | | |  |
|  | Sea level | 500 | 2,000 | 5,000 |  |
| Tj | 838 | 880 | 930 | 1,042 |  |
| Mj | 41.90 | 44.00 | 46.50 | 52.10 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Assume that: T2jk = 196,645 NOTE!! These sums of squared totals

Note that: T2Cj = 3,427,308 haven't yet been divided by anything!

Assume that: T2Rk = 760,805

a) Carry out an ANOVA on these data (10 points)

b) Compute the *real* confidence interval suitable for going around each sample mean—i.e., the confidence interval that genuinely captures the condition population mean. (6 points)

c) Compute the *within-subjects* confidence interval, suitable for going around each sample mean—i.e., the confidence interval relevant for assessing the *pattern* of the four population means. (9 points)

d) Suppose that you carried out the “subject-variance-removal” technique that was described in class. Re-do your ANOVA from Part (a). Be sure to include all sums of squares in your table. (5 points)