## Psychology 318 Exam #5

## June 1, 2009

### 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. **Always assume homogeneity of variance unless told otherwise.**

11. **Always indicate degree of freedom in your answers whenever it is appropriate.**

12. **Always use an  level of .05 unless told otherwise.**

13. Good luck!

### Grading

Problem Points Grader

1a-b 50 Courtney

2a-b 40 Andy

3a-b 5 Zack

4 5 Zack

TOTAL /100

1. Ashley, who does sleep research decides to investigate the relation between sleep deprivation and puzzle-solving time.

Ashley plans an experiment in which five sleep-deprivation times are investigated: 12, 14, 18, 24, and 30 hours. She randomly assigns n = 18 subjects to each of the J = 5 sleep-deprivation time conditions.

Ashley has two hypotheses:

H1: For **deprivation times of 12-24 hours only**, puzzle-solving time increases linearly with sleep-deprivation time. **IMPORTANT: Note that the levels of sleep-deprivation time aren't evenly spaced.**

H2: At a deprivation time of 30 hours people will go into “hyper mode” and will have the shortest puzzle-solving times of all.

The mean puzzle-solving times (in minutes) for the 5 sleep-deprivation groups are shown in the table below in the row labeled " Mean (Mj) in minutes ".

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Sleep Deprivation time (Hours) | | | | |
|  | 12 | 14 | 18 | 24 | 30 |
| Mean (Mj) in minutes | 1.2 | 1.1 | 1.8 | 1.5 | 1.0 |
| Wj (H1) |  |  |  |  |  |
| Wj (H2) |  |  |  |  |  |

**Note that SSB = 7.704**

**Assume that SSW = 17.000**

a) Make up weights corresponding to the two hypotheses. Your weights must all be integers. Demonstrate that these two sets of weights are independent. Place these weights in the table above. (25 points)

b) Make an ANOVA summary table that includes all the relevant information that you can get using the planned comparison technique, including significance of hypotheses and residual and percent variances. How would you interpret these data? (25 points)

2. In a follow-up experiment to the one described in Question 1, Ashley uses sleep-deprivation times of 12, 14, 16, and 18 hours only. She adds a second factor to her design which is "Problem difficulty". She hypothesizes that the high-difficulty problems will always take twice as long to do as the low-difficulty problems.

a) Using the table below, fill in weights corresponding to the single hypothesis: “Problem-solving time will increase linearly with sleep-deprivation time, and Difficult problem will take twice as long as Easy problems”. Your weights must all be integers.

Hint 1: It is very important in this problem to use the "make up any numbers you want first, then make them add to zero" trick).

Hint 2: Remember that your weights need add to zero *only* across all 8 cells.

(30 points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Weights | Sleep Deprivation time (Hours) | | | |
|  | 12 | 14 | 16 | 18 |
| Easy Problem |  |  |  |  |
| Difficult Problem |  |  |  |  |

b) Make up data (puzzle-solving time in minutes) such that the weights you created in Part (a) account for *all* of the SSB that would be calculated from your data. Use the table below for your data. Note that you should be able to do this, with minimal calculation, whether or not your answer to Part (a) is correct. Note also that your answer shouldn't depend on n, the simple size. (10 points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data | Sleep Deprivation time (Hours) | | | |
|  | 12 | 14 | 16 | 18 |
| Easy Problem |  |  |  |  |
| Difficult Problem |  |  |  |  |

3. Suppose you have an experiment with J = 4 conditions.

Here is a set of weights corresponding to a hypothesis, H1: -1 -1 1 1

a) Make up weights corresponding to two additional hypotheses, H2 and H3 such that H1, H2, and H3 are all mutually independent. (2 points)

b) Suppose that you have done Part a of this problem correctly. Suppose you then compute sums of squares corresponding to the three hypotheses along with a sum of squares corresponding to the residual. What would be the sum of squares of the residual? (3 points)4. Suppose you have a set of J means, Mj, and a corresponding set of weights Wj. Now suppose that you make up a new set of weights, Wj’ by multiplying each of your original weights by some constant, k, i.e., for each condition j, Wj’ = Wj x k.

Show algebraically that, in general (i.e., not using a specific example) that the sum of squares you’d get by using the Wj’ weights would be the same as it would using the original Wj weights. (5 points)