Grad. Statistics Take-home exam

There are three questions. You are on your honor not to talk with each other about this exam. Due in class on Tuesday, March 31.

Question 1

20 pairs of rats are selected from litters. Half of the pairs are reared apart from each other, in separate cages, the other half are reared together in the same cage. Within each pair, one litter mate is randomly given a drug that induces lethargy. The other is not given the drug. The activity level of each rat is recorded at three different time points, immediately after having received the drug or not, one hour later, and two hours later.

Specify the models A and C that you would use to address each of the following hypotheses. Additionally specify n-pa for each question. Make sure that you clearly define all variables that are included in your models.

1. Rats who receive the drug show greater lethargy at all time points than rats who do not receive the drug.

2. Rats who are reared apart show more lethargy at all time points than rats who are reared together.

3. The difference in lethargy due to the drug is larger in rats reared apart than in rats who are reared together.

4. There is a linear decrease over time in the magnitude of the lethargy difference due to the drug.

5. Even at hour two, there remains a significant effect of the drug on lethargy levels.

6. The effect of the drug on lethargy levels decreases over time more quickly in rats who are reared together than in rats who are reared apart.

Question 2

The purpose of this question is to get you to think about examples of mixed designs in your own subfield. What we want you to do is to generate a hypothetical mixed design (some within factors and some between factors – at least one of each) that might be used to address some substantive question in your particular field of psychology, behavioral science, business, biology, or whatever. Within the context of this design, we then want you to write out a set of hypotheses that you would expect given the design and your knowledge of what might be reasonable hypotheses in the area. Next, you should give us cell means for all cells in the design, consistent with the hypotheses you have outlined.

Finally, we want you to give us an outline of the analyses you would conduct (using our W approach). This should include a specification of all variables included in every regression model you would estimate as well as a listing of the specific regression equations you would estimate (using b's to refer to estimated coefficients rather than actual numbers). In these models, indicate which coefficients you would expect to be significant, given the hypotheses that you have provided and the cell means you made up.

Question 3

There have been a variety of theories about the nature of imprinting in ducks, geese, chickens, etc. (Imprinting is when the newly hatched chick becomes attached enough to the mother to follow her wherever she goes.) One hypothesis is that there is a critical period in which imprinting must take place. If the chick is not exposed to the mother before this critical period ends, then (according to the hypothesis) imprinting will be much less strong or may not occur at all. Another hypothesis is that imprinting is just a behavior like any others and so is learned. According to that hypothesis, imprinting will get stronger with practice, no matter when it begins. Of course, both hypotheses may be correct.

The following experiment has been conducted to explore these issues. The dependent variable is an imprinting score determined by the amount of time a chick spends in proximity to a stuffed hen that moves around a pen in the laboratory. The stuffed hen travels along a fixed path on a pulley. The pen is divided into grids and the chick's imprinting score is incremented for each 5-second period in which it is in the same grid as the stuffed hen. All you really need to know about the dependent variable is that higher scores indicate stronger imprinting.

The chicks are kept isolated until they are first tested. Half the chicks are first tested at 10 hours old and the other half at 20 hours old because the belief is that the critical period ends somewhere between 10 and 20 hours. Each chick is tested three times, each test being one hour apart. Attached are YOUR data for this experiment. Note that everyone in the class has different data.

Do a complete analysis of these data being sure to answer such key questions as: Does time of first test affect imprinting scores? Do imprinting scores increase with experience? If so, is the increase the same for the younger chicks as the older chicks? You can do these analyses either on the computer or by hand. In either case, provide the estimated models (including definitions of all variables in these models).

Write up your analysis in a paragraph or two (with perhaps a graph or two) in the style that would be used in a results section of a journal article.

Note: In the attached output, CONDITION A is the 10-hour old group and CONDITION B is the 20-hour old group.