STAT 217: Sections 2.5 and 2.6 reading comprehension and research survey

Make sure you have read up to 2.7 before attempting these problems and consider utilizing the browser version of the textbook as you work on these questions (https://arc.lib.montana.edu/book/statistics-with-r-textbook/). The answers will be used for research purposes (if you consent to this usage below) but will also be graded. By completing the additional activity (research survey or alternative activity if you choose not to participate in the research), you will gain access to a bonus on your grade of these questions. We will discuss these ideas in class on Friday but this will help us assess your success in learning these topics before getting a lecture on them. The survey questions that follow will help us to assess the different book formats.

* Required

What is your first name? *

What is your last name? *

What is your preferred email address? *

Graded questions

The following 12 numbered questions constitute the graded component of this activity. After completing them, you will select whether you want to participate in the research activity or complete the alternative activity.

Unethical Behavior: Study Description

As a part of a study of unethical behaviors of people, Piff et al. (2012) randomly assigned subjects to either think about the benefits of greed or to be neutrally primed in their thinking, then they answered a set of questions that allowed to the researchers to quantify each subjects potential for unethical behavior on a scale from 1 to 7. They also categorized subjects based on socio-economic status as either lower or upper class. The researchers were interested in whether the “Prime” – thinking about benefits of greed or not - had an impact on their potential for unethical behavior and whether these impacts differed based on socio-economic status.

Piff, P., Stancato, D., Cote, S., Mendoza-Denton, R., Keltner, D. (2012) Higher social class predicts increased unethical behavior. Proceedings of the National Academies of Science. 109(11), p 4086-4091.

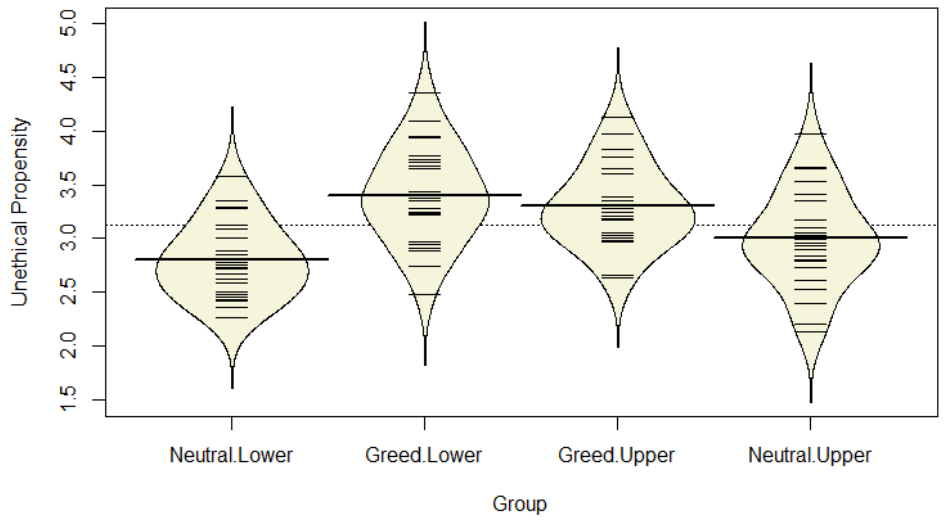
Specifically, they note that before they collected data “When the benefits of greed were not mentioned, we expected that upper-class individuals would display increased unethical tendencies compared to lower-class individuals. However, when the benefits of greed were emphasized, we expected lower-class individuals to be as prone to unethical behavior as upper-class individuals.”

The “Prime” randomly assigned variable had two levels, “Neutral” and “Greed”, where the subjects listed three things about their day (neutral) or three benefits of greed (greed) to “prime” them into a neutral or greed mode of thinking. There are two levels of socio-economic status (“Lower” and “Upper” in variable Class). The response is a quantitative measure of propensity to engage in unethical behaviors at work with higher values related to more propensity.

The real data set was not available but the following simulated data set resembles their published results.

The following beanplot summarizes the unethical propensity results for the combinations of Prime and Class. Note the group labels for the four combinations that were used in the plot.

Beanplot of responses



The following results show the estimated model and summarize the One-Way ANOVA comparing these groups.

```
> m1<-lm(UnethicScore~Prime.Class,data=unethdata)
> summary(m1)

                        Estimate Std. Error t value Pr(>|t|)
(Intercept)              2.80000    0.08165  34.293  < 2e-16 ***
Prime.ClassGreed.Lower   0.60000    0.11547   5.196 1.14e-06 ***
Prime.ClassGreed.Upper   0.50000    0.11547   4.330 3.66e-05 ***
Prime.ClassNeutral.Upper 0.20000    0.11547   1.732   0.0865 .

Residual standard error: 0.4082 on 96 degrees of freedom
Multiple R-squared:  0.2622,   Adjusted R-squared:  0.2392
F-statistic: 11.37 on 3 and 96 DF,  p-value: 1.894e-06


> anova(m1)
Analysis of Variance Table

Response: UnethicScore
             Df  Sum Sq Mean Sq F value    Pr(>F)
Prime.Class   3  5.6875 1.89583  11.773 1.236e-06 ***
Residuals    96 15.4589 0.16103
```

1) Based on the ANOVA results, we can conclude that: *

- ○ There is strong evidence to suggest that all four (Greed.Lower, Neutral.Lower, Greed.Upper, and Neutra.Upper) true mean unethical propensities are different.
- ○ There is no evidence to suggest that all four (Greed.Lower, Neutral.Lower, Greed.Upper, and Neutra.Upper) true mean unethical propensities are different.
- ○ There is strong evidence to suggest that at least one of the four (Greed.Lower, Neutral.Lower, Greed.Upper, and Neutra.Upper) true mean unethical propensities are different.
- ○ There is no evidence to suggest that at least one of the four (Greed.Lower, Neutral.Lower, Greed.Upper, and Neutra.Upper) true mean unethical propensities are different.

2) When the researchers state that "When the benefits of greed were not mentioned, we expected that upper-class individuals would display increased unethical tendencies compared to lower-class individuals." what null hypothesis are they wanting to test: *

- H0: The true mean of Neutral.Lower is the same as the true mean of Neutral.Upper
- H0: The true mean of Lower is the same as the true mean of Upper
- H0: The true mean of GreedI.Lower is the same as the true mean of Neutral.Lower
- H0: The true mean of Neutral.Lower is the same as the true mean of Greed.Upper
- H0: All the true means of the groups are equal.

3) If the researchers' expectations ("When the benefits of greed were not mentioned, we expected that upper-class individuals would display increased unethical tendencies compared to lower-class individuals.") are correct and we form a confidence interval for the difference between Neutral.Upper and Neutral.Lower (Neutral.Upper – Neutral.Lower), what would we expect to see from a confidence interval: *

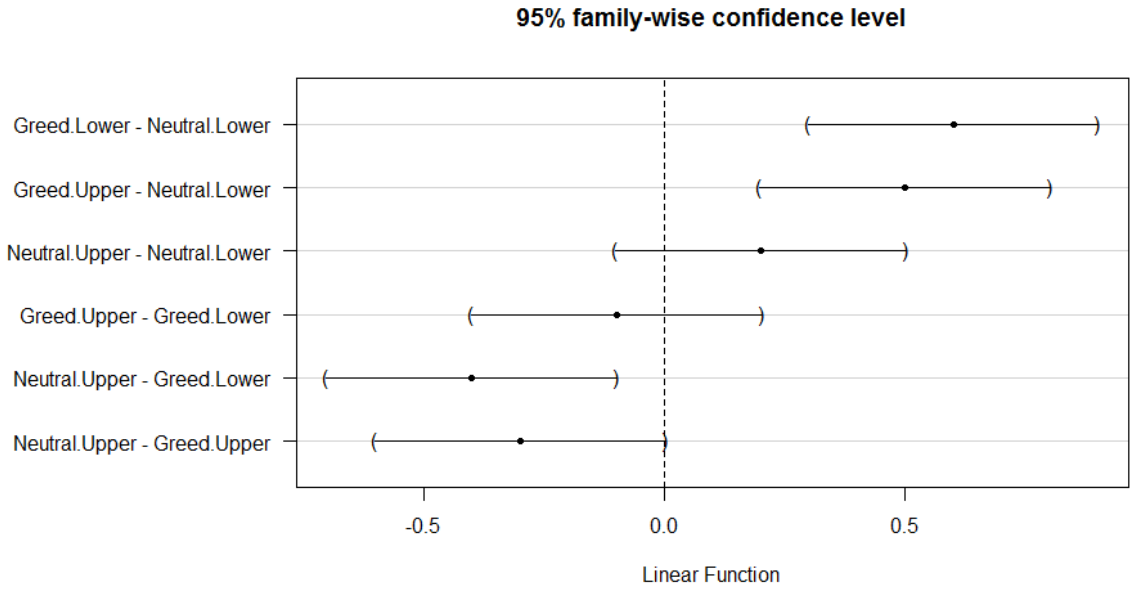
- That the confidence interval does not contain 0 and that the endpoints are both greater than 0.
- That the confidence interval does not contain 0 and that the endpoints are both less than 0.
- That the confidence interval would contain 0.
- We can't form a confidence interval here because we are interested in differences between means.

4) After reading Sections 2.5 and 2.6, in general, what is the main reason for doing all possible pairwise comparisons? *

- When no evidence is found for overall differences, then doing all possible pairwise comparisons will find evidence of differences that the researchers were interested in.
- When evidence is found for some overall difference, there is often an interest in finding out which groups are detected as being different.
- Because the results of all pairwise comparisons are simple to report, especially when there are many groups.
- Because there are fewer assumptions involved in doing pairwise comparisons than in the regular ANOVA.

The following output contains the information for running Tukey's HSD on this model:

```
> require(multcomp)
> res1<-glht(m1,data=unethdata,linfct=mcp(Prime.Class="Tukey"))
> confint(res1)

         Simultaneous Confidence Intervals
Multiple Comparisons of Means: Tukey Contrasts

Quantile = 2.6152
95% family-wise confidence level

Linear Hypotheses:
                                  Estimate  lwr       upr
Greed.Lower - Neutral.Lower == 0   0.600000  0.298018  0.901982
Greed.Upper - Neutral.Lower == 0   0.500000  0.198018  0.801982
Neutral.Upper - Neutral.Lower == 0 0.200000 -0.101982  0.501982
Greed.Upper - Greed.Lower == 0    -0.100000 -0.401982  0.201982
Neutral.Upper - Greed.Lower == 0  -0.400000 -0.701982 -0.098018
Neutral.Upper - Greed.Upper == 0  -0.300000 -0.601982  0.001982

> cld(res1)
Neutral.Lower   Greed.Lower   Greed.Upper Neutral.Upper
          "a"           "c"          "bc"          "ab"
> summary(res1)

         Simultaneous Tests for General Linear Hypotheses
Multiple Comparisons of Means: Tukey Contrasts

Linear Hypotheses:
                                  Estimate Std. Error t value Pr(>|t|)
Greed.Lower - Neutral.Lower == 0   0.6000     0.1155   5.196  < 0.001 ***
Greed.Upper - Neutral.Lower == 0   0.5000     0.1155   4.330  < 0.001 ***
Neutral.Upper - Neutral.Lower == 0 0.2000     0.1155   1.732  0.31288
Greed.Upper - Greed.Lower == 0    -0.1000     0.1155  -0.866  0.82232
Neutral.Upper - Greed.Lower == 0  -0.4000     0.1155  -3.464  0.00443 **
Neutral.Upper - Greed.Upper == 0  -0.3000     0.1155  -2.598  0.05205 .
 (Adjusted p values reported -- single-step method)

> old.par<-par(mai=c(1.5,3.5,1,1))
> plot(res1)
```



5) True or False: Based on the Tukey's HSD results, we are able to conclude that there is evidence of a difference between Neutral.Upper and Greed.Upper when we are considering all pairwise comparisons. *

- ○ True
- ○ False

In the following five short questions, fill in the blank with the correct numerical answers.

6) In this example, how many pairs of levels were compared? *

7) In the guinea pig study in Section 2.5 (Figure 2-18), how many pairs of levels were compared? *

8) At the 5% family-wise significance level, how many pairs of levels were detected as different in the study reported here on ethical behavior? *

9) At the 5% family-wise significance level, how many pairs of levels were detected as different in the guinea pig study in Section 2.5 (Figure 2-18)? *

10) Based on the discussion in Section 2.5, if you had an example with 5 levels of the categorical explanatory variable, how many unique pairwise comparisons does that generate? *

In the original estimated model, the baseline group is Neutral.Lower. This means that the estimated difference between Neutral.Upper and the baseline is 0.2. We can obtain a confidence interval for this difference from the ANOVA model with:

```
> confint(m1)
                              2.5 %     97.5 %
(Intercept)                2.63792664 2.9620734
Prime.ClassGreed.Lower     0.37079365 0.8292064
Prime.ClassGreed.Upper     0.27079365 0.7292064
Prime.ClassNeutral.Upper -0.02920635 0.4292064
```

11) Compare this result to the one that you obtain from Tukey's HSD for the same comparison. *

- The confidence interval from the ANOVA model is narrower because it does not account for all the tests involved in comparing all possible pairs of groups.
- The confidence interval from the ANOVA model is wider because it does accounts for all the tests involved in comparing all possible pairs of groups.
- The two intervals are not comparable because they are not centered in the same place.
- The confidence intervals are the same width because they are for the difference in the same groups.

12) In general, what would more letters in a CLD output suggest? *

- That the detected pairwise differences were large in magnitude.
- That the detected pairwise differences were small in magnitude.
- That there were few detected differences in the groups.
- That there were either more partially overlapping groups or more distinct groups of levels.

Consent for Research Data Collection

SUBJECT CONSENT FORM FOR PARTICIPATION IN HUMAN RESEARCH AT MONTANA STATE UNIVERSITY

Project Title: Book in Browser - The Reader Experience

You are being asked to participate in a research study designed to assess the differences in textbook formats being provided in STAT 217. This research will help with understanding the impacts of formats for the textbook used in the course and potential implementation of different formats for future students in the course.

There are no foreseen risks as all sections will receive access to the materials. You have a graded assignment to complete as part of the regular instructional component in the course with the score on this used for research purposes only if you agree to participate in the research project. You will receive a bonus on this assignment for timely completion of the survey. If you choose not to participate in the survey, you can earn the same bonus by completing an alternate activity that should require a similar time and effort; your score and other responses will not be included in the research data set. Based on your choice to participate or not, you will be directed into the survey or the alternative activity. Your instructor will see the graded assignment but will not have access to the survey results until after grades are submitted. Your responses will go directly to the course supervisor who will manage the data set and provide the graded component results to your instructor.

If you agree to participate in the study, we will be using your results on the assignment and you will be responding to some demographic questions and questions about the usability of the textbook format and your motivations in using it.

Participation (or not participating) will have no effect on your grade or class standing. All information will be kept in strict confidence and only summary statistics will be released.

If you have any questions about this study, please contact the course supervisor, Mark Greenwood (406-994-1962 or email:greenwood@math.montana.edu), Scott Young (406-994-6429 or email:swyoung@montana.edu), or Jan Zauha (406-994-6554 or email:jzauha@montana.edu).

If you have additional questions about the rights of human subjects, you can contact the Chair of the Institutional Review Board, Mark Quinn (406-994-4707 or email: mquinn@montana.edu).

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AUTHORIZATION: I have read the above and understand the discomforts, inconvenience and risk of this study. I understand that I may later refuse to participate, and that I may withdraw from the study at any time by directly contacting the course supervisor. A copy of this consent form is also available through D2L for my own records.

Investigator:  Date: 9/10/2015

Read the previous consent form (also available at https://dl.dropboxusercontent.com/u/77307195/consentform_2015.pdf and on D2L) and answer the following question. *

- ○ I have read the above and understand the discomforts, inconvenience, and risk of this study. I agree to participate in this research.
- ○ I do not agree to participate in this research. I will be taken to an alternate activity.