PSY 5301: Research Methods

Tarleton State University | Exam 1 | Spring 2021

Instructions: please complete each problem below and submit your completed exam in Canvas using one of two file formats: either (1) wirite your solutions on paper and scan to a PDF, or (2) embed photos of your solutions in a Word/OpenOffice document. On either method, please show (or describe) as much work as possible. Report your final answers rounded to 2 decimal places.

1. So far, we've used two tools for performing model comparison: the *p-value* and the *Bayes factor*. Explain what these are and how they are different.

2. An experimenter examining decision making asked a sample of children to solve as many problems as they could in 10 minutes. One group was told that this was a test of their innate problem solving ability, whereas a second group was told that this was just a time-filling task. The data are below:

Innate ability	3	7	4	5	8	3	5
Time-filling task	8	10	12	7	10	5	4

   Let μ_1 represent the population mean of the "innate ability" group, and let μ_2 represent the population mean of the "time-filling task" group. Use a t-test to compare $\mathcal{H}_0 : \mu_1 = \mu_2$ against $\mathcal{H}_1 : \mu_1 \neq \mu_2$. Report both a p-value and a Bayes factor, and interpret your results in the context of the problem.

3. The data below are from an experiment comparing three different treatment conditions:

Treatment 1	Treatment 2	Treatment 3
1	1	6
1	4	5
1	3	6
3	0	3
4	2	5

   (a) Perform an ANOVA on these data. Give precise definitions of $\mathcal{H}_0$ and $\mathcal{H}_1$, and compare these models using both a p-value and a Bayes factor. Interpret your results in the context of the problem.

   (b) Construct and interpret a 95% confidence interval for the mean of Treatment 2.

4. Compas et al. (1994) were surprised to find that young children under stress actually report fewer symptoms of anxiety and depression than we would expect. But they also noticed that their scores on a Lie Scale (a measure of the tendency to give socially desirable answers) were higher than expected. The population mean for the Lie Scale is known to be 3.87. For a sample of 36 children under stress, Compas et al. found a sample mean of 4.39, with a standard deviation of 2.61. Did the Compas et al. sample show an increased tendency to give socially acceptable answers? Use both parameter estimation and model comparison to determine your answer.

5. An experiment with four independent groups of size $N = 7$ yielded four treatment means of $\overline{X}_1 = 3$, $\overline{X}_2 = 6$, $\overline{X}_3 = 3$, and $\overline{X}_4 = 4$. Further, $\sum X^2 = 548$.

   (a) Compute the F statistic for an ANOVA designed to compare the means of these four groups.

   (b) Construct a 95% confidence interval for the mean of group 2.

6. Suppose that you randomly sample $N = 20$ scores from a population with unknown mean μ and obtain a 95% confidence interval of $(31.2, 38.2)$. Perform a t-test to compare the model $\mathcal{H}_0 : \mu = 30$ against the model $\mathcal{H}_1 : \mu > 30$. Report both a p-value and a Bayes factor. What can you conclude?

7. Two of your undergraduate lab assistants are responsible for running an experiment comparing performance in a lexical decision task between two independent samples, each with $N = 10$. In their lab notes, your assistants reported an F statistic of 5.74 with $SS_{\text{between}} = 45$ and a grand mean of 10. After submitting this work to a journal, the reviewers have requested that you use a t-test instead of an ANOVA, and they also want you to report the two group means. Sadly, the raw data have been corrupted, and the undergraduates have since left your lab. Can you satisfy the reviewers' request? (Hint: you absolutely can...this happened to me once!) What do you report?