

PSY 5301: Research Methods

Tarleton State University

Exam 2

Spring 2021

Instructions: please complete each problem below and submit your completed exam in Canvas using one of two file formats: either (1) write 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. The data below are from a repeated measures experiment comparing four different treatment conditions among three subjects:

Subject	Treatment 1	Treatment 2	Treatment 3	Treatment 4
#1	2	2	3	9
#2	5	5	5	5
#3	5	5	4	10

- (a) Write the full model for the data, specifying point estimates for the grand mean μ , the treatment effects α_j , and the subject effects π_i .
 - (b) Test the constrained model $\mathcal{H}_0 : \alpha_j = 0$ against the full model in part (a). Report both a p -value and a Bayes factor.
 - (c) What can you conclude from part (b)?
2. An educational psychologist is testing 3 versions of a test review module for a course. A sample of $N = 5$ students is used, each of whom interacts with the three different modules. The number of errors made is recorded below:

Subject	Module 1	Module 2	Module 3
#1	0	2	4
#2	2	2	8
#3	3	1	5
#4	0	3	6
#5	0	2	7

- (a) Write the full model for the data, specifying point estimates for the grand mean μ , treatment effects α_j , and subject effects π_i .
- (b) Test the constrained model $\mathcal{H}_0 : \alpha_j = 0$ against the full model in part (a). Report both a p -value and a Bayes factor.
- (c) What can you conclude from part (b)?

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3. A study compared the effects of two “mindful meditation” treatments on anxiety scores in two groups: Group 1 was currently taking anti-anxiety medication, whereas Group 2 had no history of such medication. The data below is a score on a standardized anxiety scale after 8 weeks of the intervention:

	Treatment 1	Treatment 2
Group 1	2,7,8,3	2,8,7,7
Group 2	0,0,2,6	12,6,9,13

- (a) Sketch a plot of the condition means implied by this experimental design. Plot **treatment** on the horizontal axis and separate lines for each level of **group**.
 - (b) Perform a factorial analysis of variance on these data. Report p -values for the main effects of **treatment** and **group** and the interaction.
 - (c) Perform a Bayesian analysis of variance on these data. Compute and report inclusion Bayes factors for each main effect and the interaction, being sure to report the prior and posterior odds for each.
 - (d) Interpret your results in the context of the problem.
4. Consider the following: you have a dependent variable Y and a covariate X . The data are below:

Group	X	Y
1	0	2.8
	2	4.2
	4	5.2
	6	5.8
2	2	3.0
	4	4.4
	6	5.4
	8	6.0

- (a) Calculate the group means \bar{Y}_j for $j = 1, 2$.
 - (b) Assuming that $\beta = 0.5$, calculate the adjusted group means \bar{Y}'_j for $j = 1, 2$.
 - (c) What effect (if any) did the covariate adjustment have on the overall results? Explain.
5. An experiment was conducted in which students in three classes were randomly assigned to three treatment groups. Students in Group 1 were given quizzes weekly. Students in Group 2 were given quizzes every other day. Finally, students in Group 3 were given quizzes every day. End-of-course achievement scores were recorded for each student. The data are available for download on Canvas.
- (a) Perform an ANOVA testing whether there are significant differences in achievement scores between the treatment groups. Report the results of your test along with the group means.
 - (b) Perform an ANCOVA to include the effect of general academic ability. Report the results of your test along with the adjusted group means.