A professor of statistics at a large Midwestern university designed an experiment to evaluate the effectiveness of four methods of online instruction: (1) providing students with a set of PowerPoint slides with no audio; (2) providing a slideshow of the PowerPoint slides with audio of the professor reading through the notes; (3) providing students with a video of the professor handwriting the notes on a smart-board without audio; and (4) providing the students with a video of the professor handwriting the notes on a smart-board with audio. The 100 students who registered for the online course were randomly assigned to one of the four conditions, yielding 25 students in each condition.

The outcome measure for evaluating the effectiveness was the score on the final exam.

The professor decided to fit a two-way ANOVA model, where the two factors are: (Factor A) note presentation method - PowerPoint or smart-board; and (Factor B) presence of audio -audio or no audio.

(a) As a first step in the analysis, the professor performed a Shapiro-Wilks test and found the p-value for the test was 0.375. What assumption does the test evaluate? What is the null hypothesis of the test? And what should the professor conclude?

(b) As a second step in the analysis, the professor performed a Levene's test and found the p-value for the test was 0.673. What assumption does the test evaluate? What is the null hypothesis of the test? And what should the professor conclude?



(d) Find the degrees for freedom for Factor A, Factor B, and the AB interaction.

(e) Is the main effect for presence of audio statistically significant?

(f) Students who received PowerPoint slides scored higher on average than students who received the video of the smart-board presentation of the notes. Discuss why it would not be appropriate for the professor to conclude that PowerPoint presentation is superior to the smart-board presentation in general.

(g) Write out the contrast for comparing the PowerPoint presentation without audio to the smart-board presentation with audio in terms of the ANOVA model parameters α,β, and (αβ).