**Research Question:**

The material in this class slowly gets harder as the semester continues (or the students get sick of the class). Run an ANOVA to determine if there are differences in quiz grade averages across the semester or if all the averages are the same. **Run ONLY THREE post hoc pairwise comparisons to determine which quiz might have the lowest score.**

**IV:** Different quizzes with different course materials

**DV:** Quiz scores – each quiz grade is listed. Quizzes were given every two weeks over material. Scores ranged from 0 to 75, but since extra credit was allowed, some scores may go up to 80 points.

Include the appropriate output into this document while answering the questions. You can also upload your excel file for data screening, which will help us figure out what happened if your answers are incorrect. In the assignment, you will delete people (the whole row) if they should be excluded.

**Accuracy:**

1. Check the data for out of range scores.
   1. Include a table showing you do/do not have out of range scores (i.e. something with min and max scores).
   2. If necessary, fix the out of range scores.
      1. Indicate what the problems were in the dataset.
      2. Make all out of range values NA.
      3. Include a summary showing that you fixed the accuracy issues (i.e. rerun the descriptives and show the min and max are correct).

**Missing data:**

1. Include information about percent complete by participant.
2. Include information about percent complete by column after you exclude participants with too much missing data.
3. Exclude all missing data.

**Outliers:**

1. Create an average quiz score column to use for the rest of data screening.
   1. You can use =average(*highlight the numbers for the* ***row*** *for the participant*).
2. Create z-scores for your average variable.
   1. Do you have any outliers?
3. Exclude those outliers.

**Additivity:**

1. Include a correlation table of quiz scores (not the average).
2. Are any of the variables too highly correlated (remember the special rules for repeated measures)?

**Normality:**

1. Include the normality histogram.
2. Interpret the graph. Does it indicate multivariate normality?

**Linearity:**

1. Include the normal PP plot.
2. Interpret the graph. Does it indicate multivariate linearity?

**Homogeneity:**

1. Include the residuals plot.
2. Interpret the graph. Does it indicate homogeneity?

**Power:**

1. Calculate the number of participants you would need for this study, assuming a large effect size.
   1. Include a screen shot or summary of the numbers you typed into G\*Power, so we can give you partial credit if you get a different sample size than us.

**ANOVA and Mauchly’s:**

1. Include the ANOVA and Mauchly’s test output.
2. Do you meet the sphericity assumption given the results from Mauchly’s test?
3. Was the overall test significant?
   1. Include the APA/AMA style write up for F (just the statistics):

**Post Hocs: REMEMBER ONLY DO THREE POST HOCS.**

1. Calculate the means and standard deviations for your levels.
2. Post hocs:
   1. What type of post hoc *test* did you run?
   2. What type of post hoc *correction* did you run?
   3. Include the *t*-test output.
3. Effect size:
   1. Calculate the effect size for your pairwise comparisons.
   2. Make sure the effect size output is included in the *t*-test output above.
4. Fill in the table below with the information from the above calculations (like the one from the notes):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mean 1 | Mean 2 | P-value | Explain? | Effect size |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Graph:**

1. Include a graph of the means and confidence interval for your ANOVA. Be sure to check the following:
   1. X-axis label
   2. Y-axis label
   3. X-axis group labels
   4. Error bars
   5. Cleaned up graph (no gray backgrounds)

**Write up:**

1. Write up an analysis of what you find in this data, including all the information you answered above. Use the example in the notes for a guide. This write up should include the following for credit:
2. Result section style (APA and AMA):
   1. Double space
   2. Times New Roman 12 point
   3. Two decimals
   4. Centered, bolded Results
3. Short description of the study/variables.
4. Data screening summary:
   1. Accuracy – did you have problems? What did you do to fix it?
   2. Missing data - did you have problems? What did you do to fix it?
   3. Outliers - did you have problems? What did you do to fix it?
   4. Assumptions:
      1. Additivity
      2. Normality
      3. Linearity
      4. Homogeneity and Mauchly’s
5. ANOVA
   1. Overall F statistic
   2. Post hoc tests / corrections and results
   3. Effect size for all tests
6. Graph with reference to the figure in the text.