

# EDUA 7850 - Design & Analysis of Educational Research (Quantitative)

## Take-Home Exam

*Baked with Pride !!*

**Due: Thursday April 9, 2020**

1. Explain three ways one could assess the degree to which a distribution of scores reflects a normal distribution.
2. Describe a single research study that could be explored either with a oneway ANOVA or a correlation.
  - 2.1. In particular, what are the independent and dependent variables?
  - 2.2. For each analysis, how might each variable be measured?
  - 2.3. Which of these two analyses (ANOVA or correlation) would you recommend to address this research question and explain why.
3. Suppose you want to study student academic motivation that will be measured with a 20-item inventory. For each item, students are asked to indicate how frequently they do the particular task or behaviour that reflects academic motivation on a 5-point scale ranging from 1 = "never" to 5 = "always". Scores across the 20 items are combined so that a higher score reflects a higher level of motivation. Within the 20 items, there are 4 items that clearly represent behaviours depicting low motivation (e.g., "I skip classes").
  - 3.1. Why can it be beneficial to have some a few items like this?
  - 3.2. Explain what would you do in SPSS to obtain the correct total score.
4. Looking at the various analyses we covered in this course, which statistical assumption is the most widely applicable? If this assumption was severely violated (in an analysis that required that assumption), what undesired result or conclusion would be more likely to happen?
5. Compare and contrast multi-factor ANOVA and multiple regression.
6. Using one or more of the following variables, *religion*, *achievement test*, and *anxiety*:
  - 6.1. Write a research question that pertains to an association.
  - 6.2. Write a research question that pertains to a difference.
  - 6.3. Write a research question that focuses only on descriptives.
7. You are a researcher in science education who is interested in the role of diagrams in instruction. You wish to investigate whether using diagrams in place of text will facilitate improved comprehension of the principles and concepts taught. To do so, you have developed a 12th-grade physics unit that incorporates the liberal use of diagrams. You will teach one of your class sections using the diagram unit and the other using the text-only unit. At the end of the unit, you plan to compare the two sections in terms of the mean levels of the students' knowledge of physics.
  - 7.1. What statistic would be most appropriate to answer this research question?
  - 7.2. What might be considered the main limitation of this particular research study?

8. Explain how one could determine if there are any values in the data file that are clearly incorrect, such as values outside of the possible range. For example, if the data file includes survey responses from items that are each scored on a scale from 1 to 5, then how might you identify values outside of the 1-5 range (e.g., someone accidentally typed a “7” when entering the data)? Note that you should suggest a procedure other than simply looking through each row and column in the data file, which can be a very laborious effort if working with a large data file!
9. Suppose that a study is performed to determine if reform teaching methods are better than traditional teaching methods.
  - 9.1. What statistic would be most appropriate here?
  - 9.2. Suppose the statistical test (that you stated in 9.1) was done and found  $p < .05$ . Explain in your own words, what “ $p < .05$ ” represents in the context of this study.
10. A researcher was interested in determining the effectiveness of a new tutoring approach for children who have difficulty learning to read. The researcher had tutored 40 children from 2 kindergarten and 2 grade-one classes (10 children from each class). She randomly assigned the children to one of two groups (20 in each group). The treatment group received the new tutoring approach. The control group received the existing tutoring approach. After 2 months, each of the 40 children was asked to read (aloud) a short story. If the child read the entire story, the treatment was considered successful. If the child was unable to read the entire story, the treatment was considered unsuccessful. Therefore, researcher’s data consisted of only the number of children who succeeded in each tutoring approach, and the remaining number who did not succeed in each tutoring approach.
  - 10.1. Considering the research question, and the type of data, which inferential statistic would be the most appropriate? Why?
  - 10.2. Suppose this researcher came to you well before data was to be collected. What other statistic would you recommend? Why?
11. Suppose you wanted to measure how much academic self-concept at the end of first year university can be predicted by high school GPA, and three other characteristics measured at the start of first year during orientation: self-esteem (measured as either low or high), educational aspirations (measured as either planning graduate school or not planning graduate school), and number of hours working part-time. In particular, you are interested to know how much academic self-concept is related to both (1) all four of these variables together, and (2) each of these four variables on their own.
  - 11.1. Explain which analysis would likely be most appropriate to answer this research question.
  - 11.2. For the analysis you have outlined in 11.1, recommend how each of the four independent variables and the dependent variable could be measured in a way that most appropriate for that analysis.