

**Psych 315, Winter 2021, Homework 8**

Due Friday February 26th by midnight.

Name \_\_\_\_\_ ID \_\_\_\_\_

Section [AA] (Natalie), [AB] (Natalie), [AC] (Ryan), [AD] (Ryan), [AE] (Kelly), [AE] (Kelly)

**Problem 1** Back before the pandemic, 123 students took Exams 1 and Exam 2 last year. The class average for Exam 1 was 82.36 with a standard deviation of 12.8, and the average for Exam 2 was 82.62 with a standard deviation of 15.95. Is this a significant change? Since each student took two tests, we can test the significance of this difference with a t-test for two dependent groups.

This is done by calculating the difference between Exams 1 and Exams 2 for each student. This gives a list of 123 differences. We then run a t-test that the mean of differences is different from zero.

The mean of these differences is  $\bar{D} = 0.26$  points (which is the same as the differences of the means) and from the data I've calculated that the standard deviation of these difference is  $s_D = 16.49$  points. In the following steps, test the hypothesis that the scores from Exam 1 are drawn from a population with a different mean than the scores from Exam 2 using an alpha value of 0.05.

a) State the null and alternative hypotheses.

b) Calculate your t-statistic

c) Find the critical value(s) of t

d) What is your decision? State it as a complete sentence using APA format. Find the p-value using the t-calculator in the spreadsheet.

e) What is the effect size? Is it small, medium or large?

f) What is the probability of making a type I error for this hypothesis test?

g) Use the appropriate power curve to determine the power of this hypothesis test. Explain what this number means about last year's tests scores in complete sentences.

**Problem 2** Also last year, for the 123 students, the correlation of scores between Exam 1 and Exam 2 is  $r = 0.36$ . Let's test the hypothesis that this correlation is significantly different from zero. We'll use an alpha value of 0.05.

a) Find the critical value of  $r$  using table G.

b) State your decision in a complete sentence.

**Problem 3** For the 93 students in 2019, the correlation between Exam 1 and Exam 2 scores was 0.54. Is this significantly different from the correlation between Exam 1 and Exam 2 scores last year (see problem 2)? Use an alpha value of  $\alpha = 0.05$ .

a) Use table H to calculate the Fisher  $z'$  values for the two correlations:

b) Calculate the-statistic:

$$z = \frac{z'_1 - z'_2}{\sigma_{z'_1 - z'_2}}$$

where

$$\sigma_{z'_1 - z'_2} = \sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}$$

c) Find the critical value of  $z$

d) State your decision in a complete sentence. For an extra challenge, use Table A to calculate the p-value. Don't forget to double the value for two-tailed test!

**Problem 4** Use R's 'cor.test' function and your survey data to determine if there is a statistically significant correlation between your high school and UW GPAs. Remember, UW GPAs are in the field 'GPA\_UW' and high school GPAs are in 'GPA\_HS'.

Hint: modify Example 1 in the R script: ComparingOneCorrelation.R