Problem 1 111 students took Exams 1 and Exam 2 this quarter. The class average for Exam 1 was 85.09 with a standard deviation of 19.08, and the average for Exam 2 was 85.46 with a standard deviation of 18.28. 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 111 differences. We then run a t-test that the mean of differences is different from zero.

The mean of these differences is $\bar{D} = 0.37$ 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 $s_D = 19.51$ 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 this year’s tests scores in complete sentences.

Problem 2 For the 111 students this quarter, the correlation of scores between Exam 1 and Exam 2 is $r = 0.46$. 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 105 students in 2016, the correlation between Exam 1 and Exam 2 scores was 0.51. Is this significantly different from the correlation between Exam 1 and Exam 2 scores this year? 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:

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

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!