

Assignment 1 – Introduction to Statistics Using R

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* Due Friday Jan 27

1 Hypothesis Testing

You are Dean of Science at Western (congratulations!). You have just met with one of the new Assistant Professors in the Department of Mathematics for his annual performance evaluation. Professor X claims that his salary is much too low and he wants you to give him a raise. He claims he is particularly good at teaching, and so he deserves a raise. As evidence of this, he provides a random sample of his teaching ratings. In his previous year, Professor X taught Section I of Calculus, and another Professor (with a higher salary) taught Section II. The students in Section I achieved the highest average grades on the final exam, which was common to both sections. Professor X provides you with the final grades of all 50 students in each of the two calculus sections ¹.

Table 1 shows mean grades for each of the two sections.

Calculus Section	I	II
Mean Final Grade	78.9	75.3

Table 1: Final Calculus Grades

There is no doubt that the average final grade in Section I is higher than it is for Section II. You are a natural skeptic however.

1. Articulate a null hypothesis in plain language.
2. Calculate the probability of observing differences between grades this large, under the null hypothesis. Show your work. Be sure to consider whether this ought to be a one-tailed or a two-tailed t-test.
3. What assumptions do you have to make when performing your analysis? If possible, test those assumptions. (hint: `bartlett.test()` will test homogeneity of variances, and `shapiro.test()` will test for normality.
4. What will you conclude about Professor X's claim? Will you give him a raise? Why or why not?
5. For your future reference as Dean, determine the minimum difference between mean grades that you would need to see in order to reject the null hypothesis. Assume everything else stays

¹<http://www.gribblelab.org/stats/data/calculus.csv>

the same (variances, sample sizes, etc). Show your work. Hint: compute the value of t needed for $p=.05$ given the degrees of freedom in the data (use the R function `qt()`), then solve for the difference between means that's required to produce that t value (using the equation for t).