

## Assignment 2

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### 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 says that among the two sections of Calculus I taught in his first year of being a Professor, his students achieved the highest average grades on the final exam, which was common to both sections.

You ask your secretary to collect some data for you (isn't it nice to have help?). You're given final grades of all 50 students in each of two calculus sections. Professor X teaches Section I. The table below shows mean grades for each of the two sections:

Calculus Section	I	II
Mean Final Grade	78.9	75.3

You can download the full dataset here:

<https://www.gribblelab.org/stats2019/data/calculus.csv>

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. (1 point)
2. Calculate the probability of observing differences between grades this large or larger, under the null hypothesis. Use a t-test. Show your work. (1.5 points)
3. What assumptions do you have to make when performing your analysis? If possible/necessary, test those assumptions. (1.5 points)
4. What will you conclude? Will you give him a raise? Why or why not? (1 point)
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 the same (variances, sample sizes, etc). Show your work. Hint: compute the value of the t statistic 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). (2 points)