

Your final project should be a written description of your idea/question, the data you found to investigate that idea/question, the statistical tools you used to extract information from the data, and a discussion of the information and what it means for your idea/question. Your work will be evaluated using the following rubric.

Idea/Question: 0-2 points. An evaluation of what you have written. What is the idea/question behind your project? Where does the idea/question come from (i.e. why is this worth investigating)?

0. The central question/idea is not stated or is very unclear.
1. The central question/idea is mostly clear and the motivation for its study is addressed.
2. The central question/idea is clearly stated as is the motivation.

Data and Statistics: 0-3 points. An evaluation of your statistical methods. Is the data relevant to the idea/question? Have you calculated statistics related to your idea/question? Have you done a thorough job of investigating relevant statistics?

0. The data is largely unrelated to the topic.
1. The data is relevant, but the statistics are largely irrelevant.
2. The data and statistics are relevant, but significant relevant statistics (of those covered in class) are absent.
3. The data and statistics are relevant and all appropriate relevant statistics have been calculated.

Discussion and Analysis: 0-3 points. An evaluation of your writing and your interpretation of the data and statistics. Do you clearly state conclusions of statistical tests or other calculations? Is your interpretation of the data and the statistics and what they mean for your idea/question accurate? Did you address potential problems (and their solutions)?

0. Largely incorrect interpretation of statistics or very unclear statement of results.
1. Somewhat incorrect interpretation of statistics or somewhat unclear statement of results.
2. Mostly correct interpretations of statistics and mostly clear statement of results.
3. Correct interpretation of statistics with a clear and thorough statement of results, including the acknowledgement of any potential problems.

General Writing: 0-2 points. An evaluation of your use of written English. Is your use of English (and especially the specialized vocabulary of Statistics) clear and accurate? Did you provide reference to any sources of data or other materials?

0. Language is often unclear or many sources are not properly cited.
1. Language is sometimes unclear or some sources are not properly cited.
2. Language is clear and concise and sources are cited.

An example of how I might write part of a project based on the analysis of Calculus III exam scores:

One-way ANOVA shows no significant evidence for exam effects. The model is $x_{ij} = \mu + \gamma_i + e_{ij}$ where x_{ij} is the score of student j on exam i , γ_i is the effect of exam i , and e_{ij} is random error. Testing $H_0 : \gamma_i = 0$ for all $i = 1, 2, 3, 4, 5$ against $H_1 : \gamma_i \neq 0$ for some $i = 1, 2, 3, 4, 5$ gives a P -value of 0.15, so we fail to reject the null hypothesis.

Two-way ANOVA shows highly significant evidence for both exam effects and student effects. The model is $x_{ij} = \mu + \alpha_i + \beta_j + e_{ij}$ where x_{ij} the score of student j on exam i , α_i is the effect

of exam i , β_j is the effect of student j , and e_{ij} is random error. Testing $H_0 : \alpha_i = 0$ for all $i = 1, 2, 3, 4, 5$ against $H_1 : \alpha_i \neq 0$ for some $i = 1, 2, 3, 4, 5$ gives a P -value of 0.00161, so we reject the null hypothesis. Testing $H'_0 : \beta_j = 0$ for all $j = 1, 2, \dots, 23$ against $H_1 : \beta_j \neq 0$ for some $j = 1, 2, \dots, 23$ gives a P -value of 1.91×10^{-15} , so we reject this null hypothesis as well.

These seemingly contradictory results show that that aggregate scores on the exams do not differ significantly. On the other hand, individual students' scores on the exams do differ significantly. This means that if a class took only one exam, then grades for the class as a whole would not be significantly different. Individual students, however, might end up with very different grades than they would have if they had taken more exams.