

## Data Analysis and Interpretation

1. Start this section with a paragraph telling the reader how you know you collected reliable data. Discuss the control, randomization and replication. How you performed each and what each aspect, control, randomizing and replicating does in the experiment.
2. Next, graph your data. Minimally you need to make box plots of your data (put mean lines in) or other appropriate graph. In the anchor discuss spread of each distribution and what that means in relation to your experiment. In other words is your data a good representation of your measured value? Discuss overlap of the two or more distributions and discuss how close their medians and means are to each other. This should lead you to talk about doing a statistical test to see if they are significantly different or not.
3. Start another paragraph and discuss what type of statistical test you are going to run on the data and why that test is appropriate. ( Are you comparing two sample means from two independent populations, or two proportions from two independent populations or one sample mean to a known value etc.) If you are conducting a hypothesis test you should also include and explain the confidence interval if it is appropriate.
4. State how you checked your assumptions for the test you chose to use. This is where you may need to check for normality if you have less than 30 data points. Look at means and medians, shape and spread of the data. Check for outliers, how do they affect the mean? Run the statistical test with and without them, do they make a difference?
5. State your null and alternative hypotheses mathematically and also explain them in your anchor. (run the test on the computer, TI Nspire)
6. State your test statistic (the t value or z value or chi square value – whatever test you used)
7. State the corresponding P-value and give your 3 part conclusion. (reject or fail to reject  $H_0$ , relate to the problem, and explain what the p-value means). Explain the meaning of your confidence interval in relation to your problem.

### Appendix

Here is where you want to show all the sample calculations used to find your final data and your test statistic value, for example: Force if you measure acceleration, or your t value for your stat test. A sample calculation for your percent error should be shown here. Whatever order these calculations are mentioned in your paper is the order they should appear in the appendix.

If doing an ANOVA test, include table of  $n$ ,  $x_i$ , and  $s_i$ , all equations needed to get to the F statistic:  $\bar{E}$ , MSG, and MSE and explain these in the Appendix.

## Data Analysis Check List

- Opening paragraph Explain what type of data you collected quantitative or categorical and explain what measures you took to make sure your data was valid. Address randomization, why and how you randomized and the type comparative experimental design was chosen and why.
- Descriptive analysis of your data (box plots, histograms, line graphs, bar graphs etc. whatever is appropriate for your data). Graph your data and thoroughly explain it. Discuss measures of center, spread, shape and compare these values. Discuss overlap. All of this in terms of your problem.
- Explain the type of statistical analysis you are doing and why it is appropriate
- Null and alternative hypotheses if appropriate. Written mathematically and explained in the text below.
- Check of assumptions/conditions and **show** if they are met.
- The test statistic, including the equation used to calculate it, all variables defined and one example of how you calculated it. Explanation of what the test statistic represents. (calculations in appendix, state which trial number the calculation is showing– just the test statistic in paper)
- For chi square show the tables and one calculation for expected value in a two-way table.
- If doing an ANOVA test, include table of  $n$ ,  $x_i$ , and  $s_i$ , all equations needed to get to the F statistic:  $\bar{x}$ , MSG, and MSE and explain these. (Appendix)
- P-value determined from test statistic, its density curve, whether you reject or fail to reject your null hypothesis and then relate that result back to the problem (3 part conclusion).
- If doing a DOE you must show your table of averages, all appropriate graphs, graph of the standards, dot plot of the effects, show test of significance, predictor equation and parsimonious equation. Explain/interpret **all** graphs and dot plots in their anchor. What does each graph tell you about your experiment.

Don't forget all tables and graphs must be anchored, labeled and titled. All text is doubled spaced.