Things to consider when writing a report

(based on handout of B.L. Joiner)

- Be clear, informative, and concise. For example, key aspects of several regression outputs can often be better summarized in a table. Tables should only include summary and descriptive statistics that are applicable to your discussion. Often, a number of plots can be explained in one or two sentences.

- Address your report to the reader. Make sure to use proper/understandable terminology. This often requires learning something about the field. Use the client's own information, technical encyclopedias, and the library to gain this knowledge.

- Don't use unnecessary statistical jargon. You may be surprised with what a reader considers statistical jargon. If possible, it is important in face-to-face meetings to assess terminology understanding so you know the level at which to report. Always be prepared to describe things a different way.

- Explain what you now know or have discovered about the problem, with clear and concise description of how you got there. The reader rarely needs to know the step-by-step process that got you to the final model and/or conclusions, even though that is where you spent most of your time. These details can be answered in face-to-face follow-up if they arise.

- The analysis that produced the results you include must be clearly described in such a way that an adept reader could reproduce the analysis if needed. This may sound obvious and easy to do but it is not. You must try to put yourself in someone else's shoes who is not familiar with the project.

- Give practical interpretations of the results in language the reader should find understandable
    - When the flow rate increases 5%, wasted material decreases by about 2% (95% confidence interval is 1.6% to 2.4%) - describing a slope
    - It is not possible to separate the effects of flow rate and temperature because these factors were not separately varied – explaining confounding

- Include summary tables and plots in the body of the text for easy reference. Do not put all figures and tables in an appendix. Also do not refer to any parts of the output without giving a figure or table number. Think about what the plot or table is to inform the reader and make sure it's the best choice of graph to do that. Consider superimposing plots to reduce the number but don't end up with something too cluttered.

- Label all figures and tables so they can be referenced in the text. Also make sure the axes are labeled and legible. Make sure the caption is detailed enough so the figure or table is virtually understandable when viewed alone.

- Practice, practice, practice on preparing neat, effective reports. Use a word processor that helps with spelling and to a lesser degree grammar.

Report Organization – certainly not the only format but its use is very common

- **Summary/Abstract:** Should state the problem and describe what was found through analysis in a very concise manner. In a sense, it should be a synopsis of the report. Sometimes a one-page summary is all the domain expert wants. In that case a figure or table may be included. When more like an abstract, rarely should it contain any figures. May have one summary table but this is rare.

- **Introduction:** This should state the problem similar to the summary but with far more background information. You may describe the data or how the data were obtained though sometimes that will go in the next section. This section should end with some sort of description about each remaining section in the report (i.e., report structure).

- **Methods/Design of Experiment:** This may turn out to be more than one section. In this part, you identify the key aspects of the experiment needed to understand the design and/or analysis. Some elaboration may be needed to explain issues such as subsampling and repeated measures but you want to try to keep it brief and not get super technical. This section should address the experimental units, blocking, randomization, and how the measurements were taken.

- **Analysis:** This section should clearly speak to the reader. Avoid phrases like "It is clear that" or "Obviously,….". Write in enough depth so the reader can understand what was done but save the nitty gritty details for the appendix. Figures and/or tables used in this section should be self contained. You should state what you found and how you found it but you should not go through the entire analysis path you used to come to these results. ANOVA tables may or may not be necessary. Think hard about what you need and try to keep it simple. Mathematical expressions are ok provided all symbols are explained and you feel comfortable that the reader will understand. The reader is usually not interested in how you got the results but rather what the results mean.

- **Conclusions:** Although interpretation should appear throughout the document, many people tend to read the summary and conclusions first, glancing at figures and tables. Thus, it is very important to put effort into this section. You should not only rehash the results in a more concise fashion but you also want to refer back to the questions posed by the client and tie them to the results. Since the conclusion section looks back over the experiment, it can also serve as a

springboard for recommending future investigations to answer any remaining questions. Remember to consider the cost and time required to collect new data should you think to recommend this.

- **References, Appendix:** References should always be included if you refer to books or papers. The style is often journal specific. If there are details that are not pertinent to the main focus of the paper but still important, these can go in an appendix. This should not be a very large section

My personal opinions

1. Really consider your audience. Don't write a report with tons of mathematical expressions if the reader is not comfortable with math. If you do need to write an expression, perhaps use names for the variables rather than *X, Y*, and *Z*. Being slightly sloppy mathematically may make things perfectly clear to the reader.
2. Very rarely have readers looked at the data or thought about the problem as much as you have. Make sure you do not skip or assume things are known when writing the report. A reader cannot follow your unwritten train of thought.
3. Shorter is better. Consider removing paragraphs or sections that do not pertain to the main focus of the paper. See if a couple sentences can be combined into one. Do you need all the figures you're proposing to include? Or could some go in an Appendix?
4. Raw computer output is usually a no no. It often contains summaries that are not needed, results that have too many decimal places, and variable names the reader is not familiar with. It is better to enter the needed results in a table or mathematical expression yourself.
5. Be wary of active versus passive voice. The Duke Web site on scientific writing has a lengthy discussion on the pros and cons of using each voice. https://cgi.duke.edu/web/sciwriting/index.php?action=passive_voice
6. The word "data" is plural while "data set" is singular. You should not say "The data is analyzed" but rather "The data are analyzed"
7. With all the various spell-checkers, there is no reason to have misspelled words. Word processors will also check grammar so some mistakes are unacceptable.
8. Try to use the present tense rather than past when describing results. Save the past tense for actions that definitely occurred in the past (like data being collected or the data were analyzed). Thus, I prefer to have you say "The analysis shows that" rather than "The analysis showed that."
9. Be prepared to revise and revise and revise. Read the document over and over looking for poor sentence combinations, possible confusions, incorrect equations, missing words, wrong table or figure references, etc.