Your Successful STAT 404 Project: The Report

You are nearly done! Your team's careful plan for data collection has led to various analyses. Now all that remains is writing the report.

The team report should be no more than 5 single-spaced pages of text referring to numbered tables, figures, etc. appended to the end of the report. (The tables and figures do not count towards the 5-page limit.)

The rest of this document contains tips for organizing your report; you will find many of the tips useful for other technical reports, at university or in your future career.

You probably already know that dividing a technical report into smaller sections helps you to get your thoughts organized. It also helps the reader by signposting where the argument is going. Here are some suggested sections (you may need more section headings and/or subsections). The guidelines for what to include in each section are not exhaustive; please look at the marking rubric and make sure all items are "checked off" or, if not, the omissions are explained.

1. **Abstract.** Give a brief overview of the purpose of your experiment. You can also give some hints about what your conclusions are, enough to entice the reader to continue.

2. **Introduction.** You need to say enough to understand the problem and objectives and a quick guide to your approach. At the end of the introduction, give a brief outline of what the following sections will cover, e.g., "The rest of the report is as follows. Details of the experimental design will be given in Section 2, ..."

3. **Details of the experimental design.** Give enough details about the factors and the response (give units). Rather than numerous sentences, it will be easier for the reader to see at a glance the factors and their levels by constructing a table with the name, a brief description, and the levels of each factor. In the text, refer the reader to the table. You have seen many such tables in worksheets, for example. The text can then focus on anything unusual that needs explanation and the considerations leading to the choice of factors and their levels.

   Describe the experimental plan (e.g., a fractional factorial with 5 factors and 8 runs). If necessary, explain how the design was constructed, e.g., the aliasing structure you chose.

   Describe any blocking factors and the randomization. Here it is best to err on the side of plenty of detail. "The experiment was randomized," is not convincing. If you randomized the run order, say, then also give the actual run order in then data table. Exercise 7.7, based on a real example, is a good illustration.

4. **Statistical analysis.** Try to be specific about your findings, and present numerical estimated effects, recommended levels, the estimated response at the recommended levels, etc. "The high level of temperature was best" does not summarize well: the reader would have to some more calculations to assess whether the result is practically signficant. Instead, "We are 95% confident that the effect of changing temperature from 15 to 25°C is an increase in mean (a response variable) of (a confidence interval)" tells the reader immediately whether there is a result of concern.

   If interaction effects are reported you should be careful to interpret them. Numerical estimates of interaction effects are not easy to understand. Rather, refer to a table of averages or an interaction plot. Talk about how the estimated effect of one factor depends on the level of another.

Do not give excessive digits for estimates, etc. Two significant digits are usually sufficient for a standard error. Give the corresponding estimate to the same accuracy, e.g., 14.37 kg with standard error 0.54 kg, 14.4 kg with standard error 5.4 kg, or 14 kg with standard error 54 kg. Always give units of measurement for estimates and standard errors.

If a transformation has been applied you will often want to convert predictions on the transformed scale back to the original scale.

5. **Conclusions and discussion.** The conclusions are often essentially a summary of the important results.

   Evaluate what you did. What would you do differently next time if a similar experiment were conducted?

6. **Tables and figures.** Tables should be numbered Table 1, Table 2, etc. and referred to by number in the text where they are discussed. They should have self-explanatory captions. Similarly figures. Tables and figures can be collected together at the end of the report just to make it easier to check that the text meets the 5-page limit.

   Use the actual response name, factor names, and levels in tables and figures (e.g., levels 2m and 3m, not -1 and 1). Similarly, figures should have the axes clearly labelled with actual names.

   If more than one line is drawn on a plot, there should be a caption describing the lines (usually using the actual names of the levels of a factor).

7. **Units.** Except for dimensionless quantities, give the units for the factors and the data you collect. Similarly, estimates, standard errors, and intervals need units; if a transformation has been made then transformed units will be needed. Units should always be given in table headings and figure axes.

8. **Data appendix.** Include an appendix with a clear description of all variables. Upload the data and all `R` code as well as your report to `canvas.ubc.ca`. Please ensure the file names include `data`, `R-code` and `report`, respectively, so that it is clear what is in each file.