Writing Your Project Report

This material is not on this week's quiz nor on the second exam.

As you know, you need to turn in a group project report and contribution statement at the end of the semester.

The instructions for your group project say:

The final report should be written as if it were a professional manuscript that you are submitting for publication to an appropriate academic conference or journal.

 What exactly does that mean? 

Writing Your Project Report

What that means is that your report should be organized as the scientific or technical community expects, written sufficiently clearly so that when someone reads it it will be understood, and it should be free of sloppiness (typo's, grammar errors, etc.). A good way to think of this is to imagine that you are going to submit your report to be reviewed for publication.

Wherever you end up after you leave here, with high probability you will need to write reports/papers about technical work that you've done. This might be for publication, or for internal use where you are working.

Fair or not, you will be judged based on such written presentations.

Writing is very difficult for most of us. The good news is that competent technical writing is a learnable skill.

Writing Your Project Report

Accordingly, the goal here is not just to help you do well with your project report in this course, but also to give you a basic framework for writing that may be useful in your future professional work.

The following will not teach you grammar nor will it make you a literary genius. But if you do your technical writing within the framework that follows, you should be able to generate reports that are effective and are understood when they're read.

Let's start with the basics:

What is the top-level structure of most technical papers?

Top Level Structure

Title, Authors, Abstract
Introduction
Methods
Results
Discussion
References, Appendices

Pretty much any technical/research report is organized as above. It has been this way for more than a century. When you write a report, technical readers will expect it to be organized like this.

Top Level Structure

Title, Authors, Abstract

These sections are the core of most technical reports.

Introduction
Methods
Results
Discussion

Whatever they are called, they are the four critical components.

References, Appendices

What is the "secret" to writing these four sections competently?

Top Level Structure

Title, Authors, Abstract
Introduction
Methods
Results
Discussion
References, Appendices

The key to writing the core components of a technical paper like this is to recognize that there are one or two *critical questions* that each section should answer for the reader.

What question(s) do we need to answer for each of the four sections?

Introduction Section

In the Introduction, the key questions to answer are

What problem was studied, and why?

What is your primary contribution?

Your answers should typically include at least

- the motivation for your work (problem?)
- past related work of relevance*
- your central goal (contribution?)
- your hypothesis about the outcome
- the specific objectives you will address to achieve your goal

Focus on providing an intuitive understanding of your work in the Introduction, not on the technical details.

Often the final paragraph of the Introduction is a very brief overview of how the rest of the paper is organized.

*In some contexts, it is appropriate to have a separate Past Related Work section, e.g., a thesis.

Methods Section

In the Methods Section, the key question is

How was the problem studied?

Your answers should typically include at least

- the basic methodology that you used
- any algorithm/theory that you developed
- the experimental procedures you used to assess your work's effectiveness
- your analysis method for any data that you generated (e.g., statistical analysis)

Results Section

In the Results Section, the key question is

What were the findings?

Your answers should typically include at least

- key results obtained:

measurements
statistical analysis
theorems
etc.

- evidence for each contribution

tables
figures
proofs
etc.

Discussion Section

In the Discussion, the key question to answer is

What do the findings mean?

Your answers should typically include at least

- summary of the results
- significance of the results
  (relate them to past work)
- your main conclusions
- limitations of your work
- directions for future research

Writing Your Report

To summarize, the key question(s) to answer in the core sections of your group's project report are:

Introduction	What problem was studied, and why? What is the key contribution?
Methods	How was the problem studied?
Results	What were the findings?
Discussion	What do the findings mean?

We end by considering two common errors that people make when writing technical manuscripts.

What is a common error that people make in writing the abstract?

Common Abstract Mistake

The abstract is a *summary* of the entire report, not an introduction. A common error is to write the abstract as if it were a very short introduction to the paper, stating the problem and how it is studied, but stopping after that. The abstract should also include the main results and conclusions of the work. A good way to address this is to have a sentence that begins "Here we show that ...", followed by a few sentences summarizing the results and conclusions.

Although the abstract appears first in a report, many experienced writers chose to write it *last*, after the rest of the paper is complete.

What is a common error that is made in describing detailed quantitative results?

Presenting Results

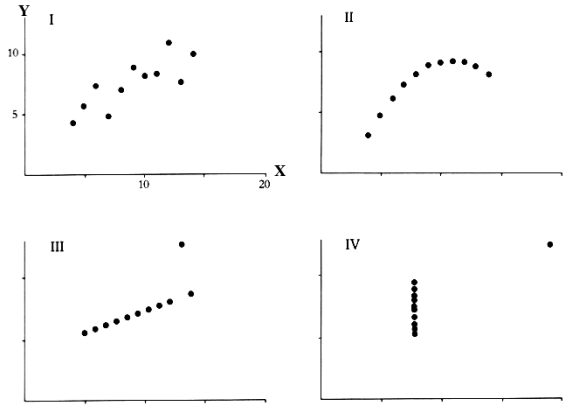
Sometimes quantitative data in presented in a way that makes it difficult for the reader to understand what is being shown.

For example, here are four sets of data, each with the same mean and the same best-fit linear regression line, presented as tabular data. Can you easily see how they differ from each other?

I		II		III		IV	
X	Y	X	Y	X	Y	X	Y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

From: Tufte, 1983

Visualizing the Same Information



Here are the same four data sets visualized in plots. It's obvious what the main differences are.

Always try to present numeric data visually like this if you want to show trends/differences. Use tables only if for some reason you need to give exact values.

And as shown with the upper left plot, always remember to label the axes.

From: Tufte, 1983