How to Write a Technical Report

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Ref: Swansea University presentation on “How to Write a Technical Report“

Introduction

- Will present how to write a technical report
- Covers the following standard technical report sections (Contents)
  - *Introduction*
  - *Theory*
  - *Method*
  - *Results*
  - *Discussion of Results*
  - *Conclusions*

Theory

- Why write?
- Importance of a good report
- Theory theory
- Best practice writing principles
- Standard structure
- Variations on a theme
- Background knowledge

Why write?

- Students Must Write
  - *Technical Reports*
  - *Lab reports*
  - *Group reports*
  - *Presentations*
  - *Blogs and wiki pages*
  - *Web sites*
  - *Technical papers*
  - *Project poster*
  - *Project dissertation*

Importance of a good report

- Need to communicate ideas to an audience
- Knowledge and skills are useless if you cannot
- communicate your ideas
- Collect information, organize it, and present it in a logical and concise form
- Report must convey the exact meaning you intend
- Well written reports will help your career
- Poorly written reports undermine your credibility and frustrate your reader

Ref: University of Waterloo Co-op Student Reference Manual.

Theory theory

- Technical reports have a standard structure
- Technical reports may not be read “cover to cover”
- Standard sections have evolved to same information to be extracted from document in different levels of detail!
- (some) Repetition and signposting is good.
- Section labelling, figure and table captioning, equations, references and citations.

BEST PRACTICE WRITING PRINCIPLES

- **Intent of a technical report is to communicate an idea/problem to a reader effectively**
- **A – B – C (ACCURACY – BREVITY – CLARITY) – "BE ON POINT AND TO THE POINT"**
- **A – I – D –A (ATTENTION – INTEREST – DESIRE – ACTION) – *"TELL THE READER WHAT YOU'RE GOING TO TELL THEM; TELL THEM AND THEN TELL THEM WHAT YOU TOLD THEM."***
- BE **STRATEGIC** AND **SELECTIVE** - PROVIDE ONLY **VALUE ADDING** AND **RELEVANT INFORMATION**
- ***LESS IS MORE"*** – HAVE AN **EFFICIENT** AND **ECONOMICAL** WRITING STYLE

BEST PRACTICE WRITING PRINCIPLES

- USE OF **VISUAL STIMULI** AND **TECHNIQUES** TO COMPLEMENT, SUPPORT AND PROMOTE A HIGHER LEVEL OF UNDERSTANDING
- ENSURE **QUALITY ASSURANCE** E.G. PROOF-READING; EDITING; SPELL CHECKING AND VERIFICATION OF INFORMATION
- "*DON'T WRITE TO IMPRESS, WRITE TO PROMOTE A HIGHER LEVEL OF UNDERSTANDING."* – BE A **AGENT OF EFFECTIVE COMMUNICATION**
- APPLY THE **WATERFALL APPROACH** – VERTICAL ALIGNMENT AND SYNERGY BETWEEN THE REPORT FINDINGS, CONCLUSION AND RECOMMENDATIONS

The Standard Structure

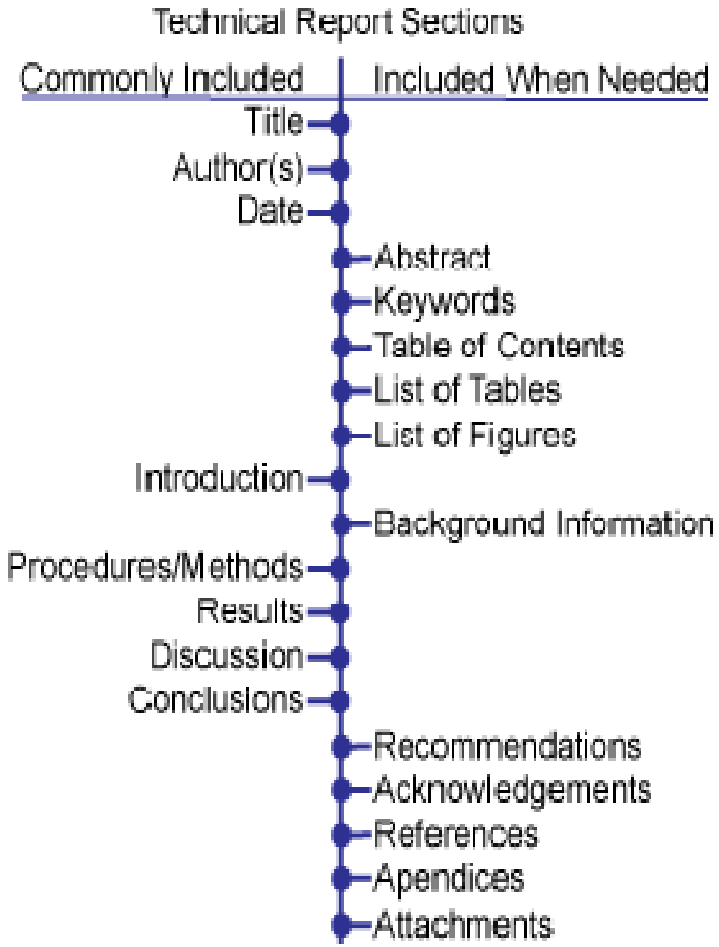
HOW TO WRITE A TECHNICAL REPORT

by
Alan Smithee

A report submitted in partial fulfillment
of the requirements for

ME 000 Some Course

Department of Mechanical Engineering
Fictitious Institute of Technology
01 January 9999



The Standard Structure

- Summary of the report
  - *Purpose, approach, main findings* in brief *(½ – 1 page)*
- Introduction
  - *To the **presentation** rather than the subject.*
  - *Purpose of study*
  - *Methodology*
  - *Results*
  - *Main findings & conclusions*
  - *Introduction to the presentation itself*

The Standard Structure

- Conclusions
  - *Purpose of study*
  - *Methodology*
  - *Results*
  - *Main findings & conclusions*
  - *Further work*
- References
  - ***All** the sources used and **cited** in the body of the report.*
- Appendices
  - *Supplementary or more detailed information that supports or expands the report (possibly for reference).*

Front and End Matter

- Give further structure and information to the report
- Front matter
  - *Table of Contents*
  - *Table of Figures*
  - *Table of Tables*
  - *Abbreviations*
- End matter
  - *Glossary*
  - *Index*
- Should be automatically generated whenever possible

Method

- Method of writing a report
- Repetition is good!
  - *How to repeat yourself*
  - *Signposting*
- Numbering
- Citations and References
- Writing a method

How to write a report

- **Start in the middle**
  - *You have done the work so you know what your approach was.*
  - *You have the results so you just have to write them up!*
  - *Ensure that you understand the background, write it up and use it to evaluate the results.*
  - *Gather your references and ensure that they are cited in the background sections and other sections as appropriate.*
  - *Write the conclusions and the introduction (in that order)*
  - *Write the summary*

Repetition is Good!

- Form of technical report has developed to allow different classes of readers to make use of the materials in different ways:
  - *Only summary may be read by a researcher looking for information or a manager seeking an "executive summary".*
  - *Only conclusions or introduction may be read by someone interested in the subject but only wanting to adopt the main findings.*
  - *The whole document may be read by someone wishing to follow-up on the work published.*
- It is important that each part tells the same story at the appropriate level of detail.
- **Repetition** and **signposts** help the reader who is not reading the document sequentially.

How to Repeat Yourself

- Say what you **will say** (*in brief*) in the Summary
- Say what you **will say** (*in more detail*) in the introduction
- Say what you **have to say** (*in full in the body*) with signposting
- Say what you **have said** (*in the conclusions*)
- Emphasise the good bits in an extended abstract or executive summary

How to Signpost

- Open each section with a statement of context:
  - *In the [last section] we ….*
  - *In [this section] we now …*
- Close each section with a statement of context:
  - *In this [section] we ….*
  - *In the [next section] we will …*
- Provide cross references
  - *As we saw in [a previous section] …*
  - *As we will show in [a later section] …*

Numbering

- Numbering important parts of the report helps with signposting
  - *Figure 2 shows ….*
  - *Better than the figure on page 3 shows*
- Things that should usually be numbered
  - *Parts, Chapters and Sections*
  - *Figures and Tables*
  - *Equations*
- Things that can be numbered
  - *Citations*

Number Sections

- It is easier to use signposting if you label your sections and subsections.
- Dissertation or larger document
  - ➢ *Part I*
    - Chapter 1.
      - Section 1.1
        - » Sub section 1.1.1
- Report or shorter document
  - ➢ *Section 1*
    - Subsection 1.1
      - Sub-subsection 1.1.1
- Word processors can make section labelling automatic and cross-referencing semi-automatic. **Learn to use those features.**
- Local rules often override general guidelines

Figures

- Give all figures a numbered caption

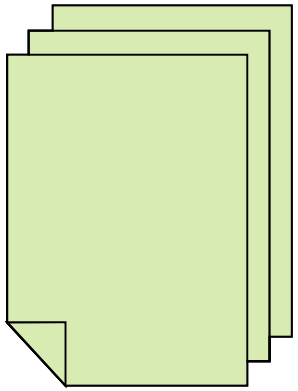


Figure 1: A Document

- Refer to figure in text. “Figure 1 shows a document.”
- Use auto-captioning and cross-referencing.

Tables

- Give all tables a caption. Caption goes above table.

Table 1: Fee fie fo fum

Fee	**Fie**
Fo	Fum

- Refer to table in text. “Table 1 enumerates useful words beginning with ‘f.’”
- Use auto-captioning and cross-referencing.

Equations

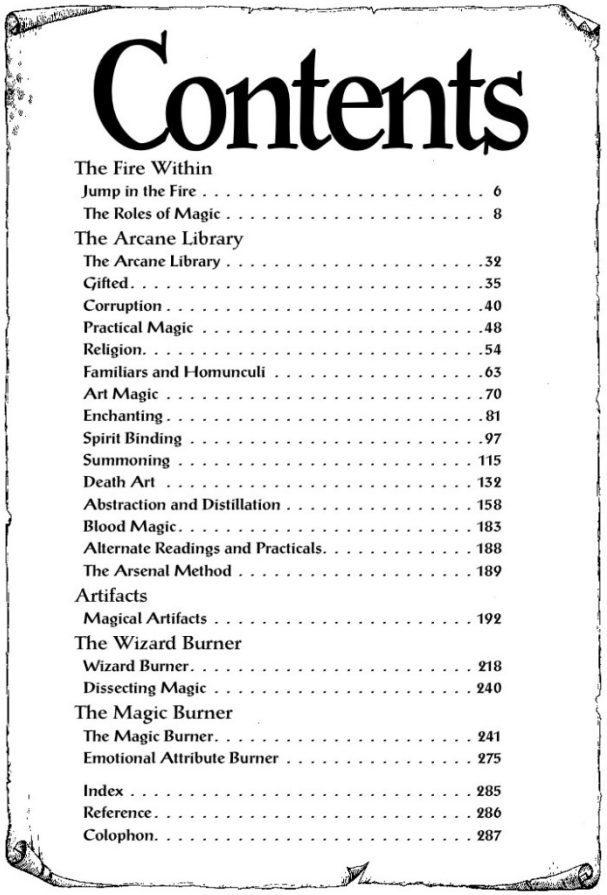
- Give all equations a label

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1}$$

- Refer to equation in text. “Equation (1) shows the formula for a quadratic.”
- Use your word processor’s equation editor to get auto-captioning and cross-referencing.

Table of Contents

- It owns a separate page
- Add page numbers for this section
- List of figures/tables follows the main table of contents and usually owns a separate page.



Contents

Abstract Vs Summary

- **Summary**

- Technical Report → Summary
- Purpose
- Scope
- Major Issues
- Main Conclusions
- 1 Page or less
- Concise

Abstract

Scientific Report → Abstract

- Problem
- Main Results
- Main Conclusions
- 1 Paragraph or less (200 words)
- Concise (strict)

Citations and References

- **Why cite at all?**
- A rich reference list is considered evidence of wider reading.
- Critical appraisal of the references with citations in the body of the report is evidence of your understanding of the materials and how your work builds on from them.
- Your cited sources provide a frame of reference against which you can evaluate your report's contribution to human knowledge

Citations

- Two main styles:
- Numeric
  - *According to Shakespeare [1] winter's discontent is now made glorious by "this son of York".*
  - *"Now is our winter of discontent made glorious summer by this son of York" [1].*
- Symbolic
  - *According to Shakespeare [1597] winter's discontent is now made glorious by "this son of York".*
  - *"Now is our winter of discontent made glorious summer by this son of York" [Shakespeare, 1597].*

Referencing

- Numeric Style

  [1] William Shakespeare, Richard III *(Act I, Scene I), Quarto 1, 1597.*

  \+ *Easy to use if references do not have to be sorted*

  – *Difficult to maintain if references need to be presented as a sorted list.*

- Symbolic (Harvard) Style

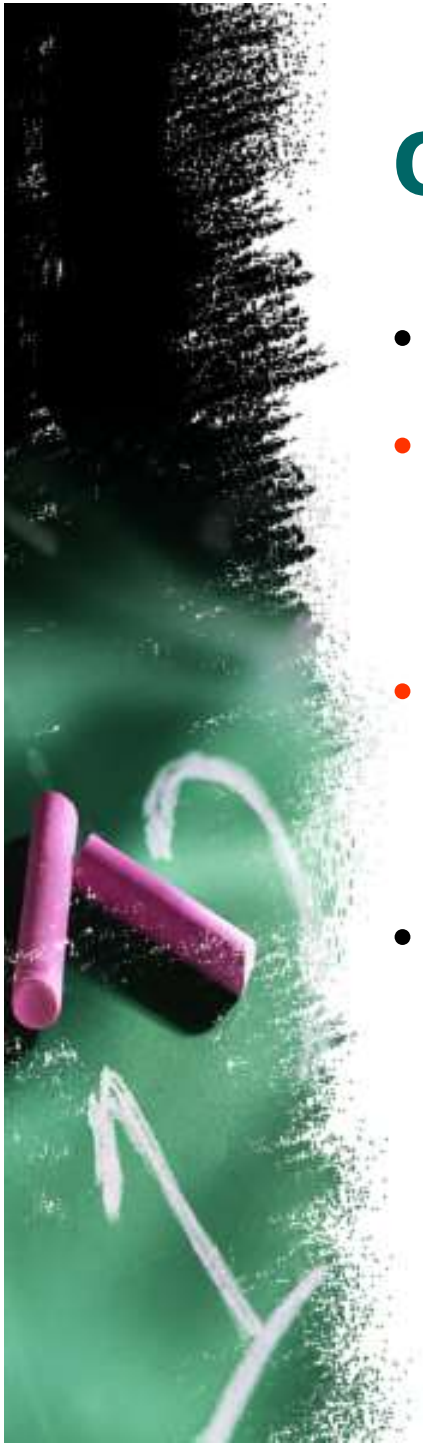
  Shakespeare, William 1597. Richard III *(Act I, Scene I), Quarto 1.*

  \+ *Easy to maintain a sorted list of references.*

  – *More verbose when citing.*

Referencing

- Technical Report
  - *References at end of document*
  - *Different publications often have different styles*
- Consider use of a bibliographic database and citing tool (e.g. “End Notes”, “Zotero” etc.) to automate citing and formatting of references.



Quoting

- Never quote documents without citing sources.
- **Copy-and-paste of large amounts of text, even with quotation marks and full attribution is considered plagiarism.**
- **Plagiarism means copying the data or reports from others (rightful owners) without there permission.**
- If you like what someone had to say on a subject, rewrite it in your own words!

URLs

- Do not rely solely on hyperlinks to present URLs
  - *A paper report will not be read on a browser!*
  - *Cite them like any other resource*
- Cite them as you would a book or article.
- URLs can move around. So provide information that will allow the reader to find the resource even if the URL has changed.
- Use as much detail as possible:

  [1] William Shakespeare, Richard III*. Online at URL: http://www.gutenberg.org/catalog/world/readfile?fk_files=53 (Project Gutenberg., 2002)*

References and Further Reading

- In academic circles, the **References** section could contain a **complete list** of **all** sources ***cited*** in the body of the report.
- Other sources that you have read and that have helped inform your work but which you have ***not cited*** should be included in a **Bibliography** or a **Further Reading** section.
- References are *essential* to understanding your work. Bibliographies are sources that were useful to you and therefore *may be useful* to your readers.

Writing a Method

- You are ***reporting*** what you did so use past tense!
- Do not quote from the lab script:
  - Wrong*: "take measurements of* x *and record results in your lab book"*
  - Right*: "we took measurements of* x *and recorded the results in our lab book"*

Don’t rewrite the instructions!

- It is acceptable to refer to the instructions if you did not divert from the suggested method.
- But cite the original source
  - *We performed* x *as suggested on Section y (page 2) of the lab handout [2].*

Passive Voice?

- Use **ACTIVE VOICE** (as opposed to PASSIVE) – written in **THIRD PERSON**
- Some publishers prefer an objective tone and "passive voice"
  - *"Measurements were taken of x and the results were recorded in a lab book"*
- You and your readers may find this a bit awkward
- Use it if you have to!
- Use of **ACRONYMS** and **ABBREVIATIONS**
- **AVOID JARGON** and unfamiliar technical terminology

PROPER SENTENCE AND PARAGRAPH STRUCTURING

- **VARY THE LENGTH** OF SENTENCES
- EASY TO UNDERSTAND CONCEPTS – **SHORTER SENTENCES**. COMPLEX CONCEPTS – **LONGER SENTENCES** TO ENABLE EFFICIENT ASSIMILATION OF INFORMATION
- **DON'T SUBSTITUTE A FULL-STOP FOR A COMMA** – *"IF YOU CAN USE A FULL-STOP USE IT!"*
- **ONE CONCEPT/KEY POINT, ONE PARAGRAPH**. DIFFERENT CONCEPT, DIFFERENT PARAGRAPH. *"DON'T MIX 'N MATCH"*
- AS YOU EXIT ONE PARAGRAPH START INTRODUCING THE NEXT ONE.

Results

- Results section presents your findings.
- Use tables, figures and equations as appropriate.
- Textual commentary is needed to tie results to method.
- Provide explanation if necessary.
- Usually easiest section to write (if you recorded the results carefully!)

Discussion of Results

- Compare results to expected results
- Account for any differences
  - *Experimental procedure wrong*
  - *Accuracy of measurements*
- Differences may point to inaccuracies in the theory section and may point to future work.
  - *"This result can be explained by experimental error" is* ***not*** *an explanation!*
- Be honest, a result that does not match the theory is itself a useful result!
- If there are questions in the lab script, they should be answered in this section.

Conclusions

- Remind the reader of what you were trying to achieve.
- Outline the theory, method, results and discussion
- Attempt to tie together the theory, results and discussion.
  - *Highlight the places where the theory was correct*
  - *Highlight the places where the theory was incorrect*
  - *Make suggestions for further work.*
- Ensure that the conclusions stands alone because it may be the only part to be read!

THANKS
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