1.0 Planning and Purpose

1.1 Purpose

Every report has a purpose. Begin your report writing by thinking about the purpose of the report. In particular, who is/are the audience of the report? What knowledge do we assume they have? What knowledge are they likely to have about the project for which the report is written? What are the key pieces of information they should take away from the report, regardless of how the report is structured or written?

1.2 Planning

One approach to report writing is to start at the beginning and write. This is counter-intuitive to an engineer: would we create a circuit by starting at the input and adding components until we reach the output? Would we write software by starting at the beginning and writing code until we are “finished”?

Instead, think about report writing as a problem to be solved. In ENGG1000 we follow a design process that includes conceptual design followed by detailed design. Let us do the same here, beginning by laying out the top-level headings for the report. Often the top-level headings may already be prescribed (some of the most common are discussed in these notes), but even if this is the case, sub-headings need to be created, so think about what sub-headings are needed for each section of the report. Going to the next level of detail, under each sub-heading it might be helpful to create “placeholders” for content that you intend to add. An example placeholder (for a figure) is shown below:

Placeholder: Block diagram showing top-down approach to report writing

Figure 1. Formation of a skeleton structure using top-down report writing

Of course you can add placeholders for whatever content you want, the more the better. Once this process is complete, what you have is a skeleton structure, or a conceptual design of the report. Advantages of this approach include:

- In the space of about 1 hour or less, you have gone from a blank sheet to a detailed task list for what will need to be done for the report.
- Because the conceptual design of the report is done all in one go, the report structure will probably make sense to a reader, even if it is written by more than one person.
- Having structured the report (i) it is now a series of small tasks rather than one big task, and better still (ii) sections or sub-sections can be allocated to different group members.
- You have not got lost in the detail of the report, and even if you do later, the overall structure will help to save it.
2.0 Introduction

The introduction first and foremost must draw the reader into the topic area and the work you are doing. The reader comes with limited knowledge of your project, so do it gently! It must have a tightly logical flow (every sentence should build on the previous sentence, leading towards the problem you are trying to solve), and include nothing that is not critical to the reader’s understanding. The introduction should avoid detailed technical discussion, focusing more on the motivation for the work and on gradually zooming in to the specific problem being addressed. It can also state the context in which the work takes place (e.g. has anyone else attempted a project like this before?). Do not forget to include the motivation for the report.

Towards the end of the section, you should give a clear and concise problem statement. After this, discuss how the design will respond to the problem statement, in general terms. You can introduce your design, but only in general terms (e.g. talking up a few of its advantages). Don’t give too much away, just get the reader interested in what will come next. You can finish the introduction by briefly outlining the structure of the report.

3.0 Relevant Knowledge

In most reports, there will be a need to discuss background knowledge that exists in text books or technical papers. The first fundamental rule (easy) is that this information must be correctly referenced. The second fundamental rule (harder) is that because the information already exists elsewhere, it should be discussed in the minimum amount of detail to explain how it relates to the problem being addressed in the report. Suppose your design includes a voltage divider, which is explained in a text book you read. You might give a circuit diagram, an equation and one or two (referenced) sentences explaining how a voltage divider works, but you should spend at least twice as many sentences explaining why a voltage divider was a good choice for your design, whether there were any suitable alternatives, and how you chose the component values. The text book did not contain these sentences; they are a result of your own insight, and they are what will earn you the respect of a reader or the marks of an assessor, not the explanation of how a voltage divider works, written by someone else. The third fundamental rule (harder still) is that existing information should be very carefully selected, so that there is exactly the right amount of background knowledge for the reader to approach your design with: not too little (design decisions will become unclear) or too much (lots of existing knowledge is not interesting to read and disrupts the flow of the report).

4.0 Presentation of Design

The fundamental rule for presenting technical content is that your intended reader should be able to understand the choices you made and be able to build your design exactly as you did. Usually, your “intended reader” is another undergraduate student (e.g. someone from a different group). You need to be as precise as possible: give circuit diagrams, list the names and values of every single component, and explain how every component value was chosen. Don’t assume the reader/marker knows as much as you do about your design (very few people will!).

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Somewhere in the section, discuss why you made the design decisions you did. In ENGG1000, your design process is about as important as the final design itself. Why? Only by reflecting on the process can you hope to improve your design skills in the future. Also, think about how meaningful someone else’s design is to you if all you have is a circuit diagram and/or some abstract technical explanation. Optionally, you may want to present alternative designs (i.e. designs you chose not to pursue). If you do, spend less time discussing the detail (or do it in an appendix), and more time explaining the pros and cons of the different designs.

5.0 Presentation of Experimental Results

For every experiment you present, (i) explain the purpose for doing the experiment and its expected results; (ii) explain in detail the method of your experiment (so that someone else could repeat it); (iii) present the results in most user-friendly format (especially if you have a lot of them); and (iv) explain the significance of the results. Be sure to use the correct units of all quantities.

6.0 Conclusion

Summarise your design, discussing how successfully it addresses the design problem, referring to key aspects or innovations in the design that you feel were significant, and referring to how your design performed during testing/experimentation.

7.0 Abstract or Executive Summary

Write the abstract last. Put the report to one side, and on a blank sheet of paper, write down the few key messages that you want to get across (e.g. the best features of your design). The abstract must get these messages through to the reader. Write the abstract last, after looking quickly through the whole report. The abstract should give the background/motivation for the design project, concisely state the problem being addressed, state the purpose of the report (not its structure!), give the key features of the final design and briefly state the key design features or outcomes of the design/project (typically 1-2 sentences for each). Do not describe the structure of the report. You need to say what you found out by doing the project! A really good abstract always impresses. Suggested length: 6-10 sentences.

8.0 Logical Flow

What is meant by logical flow? You may write the sections of the report separately, but the reader will probably read from start to finish. A well-written report will have good continuity between one section and the next. Similarly, a well-written report will have good continuity from one sentence to the next. One way to achieve this is to list the points you want to make in a section, and then write a paragraph on each: in the first sentence, explain why the point is important for the section it is in, in the next few sentences, give the detail, and in the final sentence, clearly state the “take home” message of the paragraph.

Another thing to look for in terms of logical flow is the required knowledge of the reader. Many reports begin well, discussing a design problem in general terms, but then jump into incredible detail, without first giving the reader sufficient background
either (i) in terms of the motivation for the detailed design or (ii) in terms of the technical concepts required to understand it.

A good check for logical flow is to read right through the report, looking for how well each sentence builds on the previous sentence, and how well each sentence relates to the purpose of the section. Finally, decide whether your report is getting the main messages through or not, and if not where the reader needs to be reminded of them.

9.0 Figures and Tables

Figures serve a number of important purposes, apart from the well-known “a picture equals a thousand words”. Figures provide a visual focus for the report, breaking up the text. A reader flipping or scanning through the report will be drawn to the figures. For this reason, it is important that (i) only the most essential figures are included; (ii) the figures can be easily understood by an uninformed reader and (iii) the captions are as detailed as possible in explaining not only what is in the figure but the purpose of the figure. In some instances a visual representation is particularly effective at communicating technical concepts. The block diagram is one such example. It serves to show how a system is composed of discrete sub-systems, the interaction and dependency between the sub-systems, and the inputs and outputs of the sub-systems. It also helps to quickly establish what is and is not relevant to the design.

Tables are also good for breaking up the text in a report, and similar rules apply. Tables are also good for summarizing information, e.g. if you have a number of aspects of your design for which you are debating the pros and cons, make a table with a row for each aspect and columns for the pros and cons.

10.0 Appendices

It is very often the case that we either (i) have too much content in a report, so that reading it becomes tiring, or (ii) volumes of technical detail, which do not contribute to the overall flow of the report, need to be included. In the case of (i), think carefully about whether the content can be organized to make it easier for the reader (e.g. split up into sub-sections, organize using a list or table), however if there is detail that seems even slightly tangential to the report then a reader will definitely find it annoying. Here, an appendix is ideal. Move the tangential material into an appendix, and then tidy up both the body of the report and the appendix. In the case of (ii), an appendix is well suited to technical details that disrupt the readability of the body of the report. A few rules: do create separate appendices for each concept (don’t just put them all in one appendix) and label them (Appendix A, Appendix B, etc); don’t move anything that is important for your argument or flow to an appendix; do refer to your appendix, once you’ve created it; and do think about whether you really need each appendix at all. Carefully used appendices can turn a boring report into a tight, well-structured report.

Please note: These notes are intended to provide key basic knowledge required to get started in ENGG1000, and to complement the lecture stream.