[enumerate]itemsep=0mm, topsep=5pt, partopsep=0mm, parsep=0mm [enumerate,1]label=0., ref=0 [enumerate,2]label=., ref= [enumerate,3]label=., ref= [itemize]itemsep=0mm, topsep=5pt, partopsep=0mm, parsep=0mm [itemize,1]label=• [itemize,2]label=○ [itemize,3]label=–

thesis.bib

latex name=latex, description=Is a mark up language specially suited for scientific documents

bibliography name=bibliography, plural=bibliographies, description=A list of the books referred to in a scholarly work, typically printed as an appendix

maths name=mathematics, description=Mathematics is what mathematicians do

phdPhDphilosophiae doctor CoPCSECoPCSE@NTNUCommunity of Practice in Computer ScienceEducation at NTNU gcdGCDGreatest Common Divisor

An NTNU Thesis LaTeX Document Class

Community of Practice in Computer Science Education at NTNU

CC-BY 2019/07/18

listingCode listingCode listings paperPaperPapers

Abstract

The `ntnuthesis` document class is a customised version of the standard LaTeX `report` document class. It can be used for theses at all levels – bachelor, master and PhD – and is available in English (British and American) and Norwegian (Bokmål and Nynorsk). This document is ment to serve (i) as a description of the document class, (ii) as an example of how to use it, and (iii) as a thesis template.

Sammendrag

Dokumentklassen `ntnuthesis` er en tilpasset versjon av LaTeX' standard `report`-klasse. Den er tilrettelagt for avhandlinger på alle nivåer – bachelor, master og PhD – og er tilgjengelig på både norsk (bokmål og nynorsk) og engelsk (britisk og amerikansk). Dette dokumentet er ment å tjene (i) som en beskrivelse av dokumentklassen, (ii) som et eksempel på bruken av den, og (iii) som en mal for avhandlingen.

Contents

Figures

Tables

Code Listings

[type=]

Chapter 1

Introduction

Over the years, several thesis templates for LaTeX have been developed by different groups at NTNU. Typically, there have been local templates for given study programmes, or different templates for the different study levels – bachelor, master, and phd.[1]

Based on this experience, the CoPCSE[2] is hereby offering a template that should in principle be applicable for theses at all study levels. It is closely based on the standard LaTeX `report` document class as well as previous thesis templates. Since the central regulations for thesis design have been relaxed – at least for some of the historical university colleges now part of NTNU – the template has been simlified and put closer to the default LaTeX look and feel.

The purpose of the present document is threefold. It should serve (i) as a description of the document class, (ii) as an example of how to use it, and (iii) as a thesis template.

[1] see, e.g., `https://github.com/COPCSE-NTNU/bachelor-thesis-NTNU` and `https://github.com/COPCSE-NTNU/master-theses-NTNU`

[2] `https://www.ntnu.no/wiki/display/copcse/Community+of+Practice+in+Computer+Science+Education+Home`

Chapter 2

Using the Document Class

2.1 Thesis Setup and Language Selection

The document class is initialized by issuing the `\documentclass[]{ntnuthesis}` at the beginning of your `.tex` file. The thesis language should be given as an option. Currently British English (class option `[british]`), American English (class option `[american]`), Norwegian Bokmål (class option `[norsk]`) and Norwegian Nynorsk (class option `[nynorsk]`) are supported.[1]

There is also the `titlepage` class option that triggers the generation of a simple title page that can be used as a placeholder when writing the thesis. This option should be removed before handing in the thesis. Instead the official NTNU titlepage for the corresponding thesis type should be added as described on Innsida.[2]

2.2 Title, Author, and Date

In the preample of the `.tex` file, the thesis title should be set with the `\title{}` command. The title will appear on the titlepage as well as in the running header of the even numbered pages. If the title is too long for the header, you can use `\shorttitle{}` to set a version for the header.

The authors should be listed with full names in the `\author{}` command. If there are several authors, they should be separated with `\and`, e.g., like this: `\author{Anne Andersen \and Bjørn Bjørnsen}`. For the running headers, you may want to use `\shortauthor`, e.g. like this: `\shortauthor{A. Andersen and B. Bjørnsen}` or even `\shortauthor{Andersen et al.}`.

Use `\date{}` to set the date of the document. It will only appear on the temporary title page. To keep track of temporary versions, it can be a good

[1] Disclaimer: this unfortunate naming of the Norwegian language options follows from the naming conventions of the `babel` package.

[2] see `https://innsida.ntnu.no/wiki/-/wiki/English/Finalizing+the+bachelor+and+master+thesis` for bachelor and master, and `https://innsida.ntnu.no/wiki/-/wiki/English/Printing+your+thesis` for PhD.

idea to use `\date{\today}` while working on the thesis. You may also add copyright and licence information in this field.

2.3 Page Layout

The document class is designed to work with twosided printing. This means that all chapters start on odd (right hand) pages, and that blank pages are inserted where needed to make sure this happens. However, since the theses are very often read on displays, the margins are kept the same on even and odd pages in order to avoid that the page is jumping back and forth upon reading.

To avoid blank pages when rendering the thesis, you can enable the `oneside` option in the `thesis.tex` file. Just add 'oneside' to the document class options on the first line, and recompile.

2.4 Structuring Elements

The standard LaTeX elements for document structure are supported: chapter, section, and:

2.4.1 This is a `\subsection{}`

Short subsection text here.

This is a `\subsubsection{}`

Short subsubsection text here.

This is a `\paragraph{}` Short paragraph text here.

Chapters, sections, and subsections will be included in the table of contents, whereas the lower level structuring elements will not appear there. Don't use too many levels of headings; how many are appropriate, will depend on the size of the document. Also, don't use headings too frequently.

Make sure that the chapter and section headings are correctly capitalised depending on the language of the thesis, e.g., '*Correct Capitalisation of Titles in English*' vs. '*Korrekt staving av titler på norsk*'.

Simple paragraphs are the lowest structuring elements and should be used the most. They are made by leaving one (or more) blank line(s) in the `.tex` file. In the typeset document they will appear indented and with no vertical space between them.

2.5 Lists

Numbered and unnumbered lists, i.e., the `enumerate` and `itemize` environments, are used just as in regular LaTeX, but are typeset somewhat more densely and with other labels. Unnumbered list:

- first item
- second item
    - first subitem
    - second subitem
        - first subsubitem
        - second subsubitem
- last item

Numbered list:

1. first item
2. second item
    (a) first subitem
    (b) second subitem
        i. first subsubitem
        ii. second subsubitem
3. last item

For description lists, see usage in, e.g., sec:frontmatter.

2.6 Figures

Figures are placed in the `figure` environment. An example is shown in fig:mapNTNU. Figures are floats, hence they will float freely around in the document in accordance with standard LaTeX behaviour. You may want to try to override LaTeX's default placement by using the `h` (here), `t` (top of page), `b` (bottom of page), and `p` (separate page) options in order of priority. If you provide an alternate (typically shorter) caption in square brackets, it will be used in the list of figures. Use `\includegraphics[]{}` with options `scale` or `width` to include the graphics file. The caption should be placed *below* the figure. If the caption consists of a single sentence fragment (incomplete sentence), it should not be punctuated. Given the shape and size of the figure, the figure caption can appear too close or too far from the figure. To deal with this, vertical space, either positive or negative, can be added before and/or after the caption command using the `\vspace` command.

For figures compsed of several sub-figures, the `caption` and `subcaption` packages have been preloaded. See fig:subfig with sfig:a,sfig:b for an example. For more details on alignment etc., see the Overleaf documentation.[3]

[3] `https://www.overleaf.com/learn/latex/How_to_Write_a_Thesis_in_LaTeX_(Part_3):_Figures,_Subfigures_and_Tables`

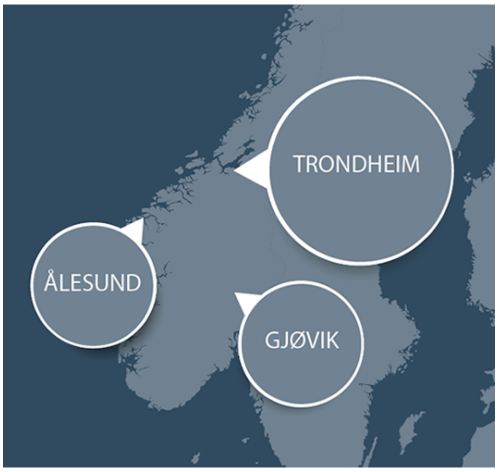
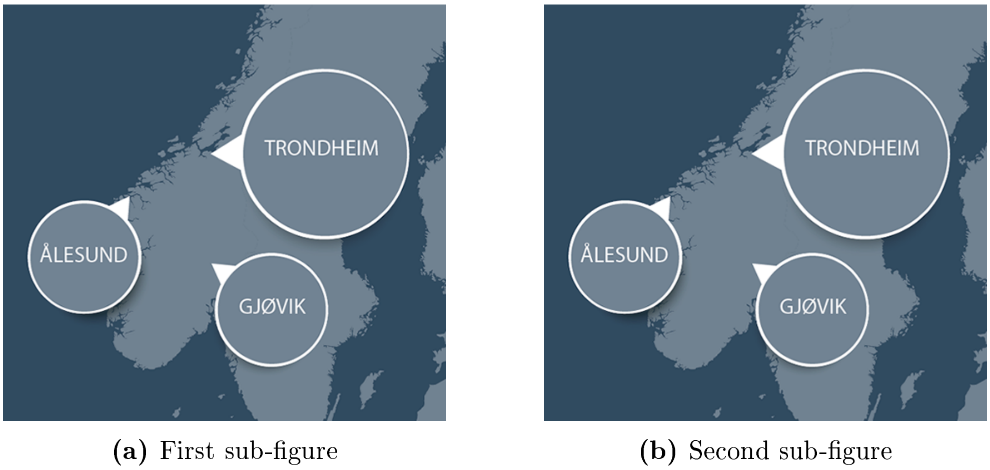


Figure 2.1: The map shows the three main campuses of NTNU.



(a) First sub-figure

(b) Second sub-figure

Figure 2.2: A figure composed of two sub-figures. It has a long caption in order to demonstrate how that is typeset.

Table 2.1: A simple, manually formatted example table

age	IQ
10	110
20	120
30	145
40	120
50	100

Table 2.2: A simple example table generated from a CSV file using `simplecsv` and `booktab`

csvtables/ageiq.csv

You can make nice graphs directly from data files using `gnuplot`, but it is expensive on every compilation. The code is included in the raw latex as a comment so you can uncomment that code to see how it works.

2.7 Tables

Tables are placed in the `table` environment. An example is given in tab:example1. Like figures, tables float freely around in the document in accordance with standard LaTeX behaviour. The table caption should be placed *above* the table. If the caption consists of a single sentence fragment (incomplete sentence), it should not be punctuated.

Tables can also be automatically generated from CSV files using the `simplecsv` and `booktab` packages. See tab:examplecsv for an example.

2.8 Listings

Code listings are included by means of the `listings` package. Code examples can be read from file or provided inline, and should be given a caption for cross referencing and for appearance in the list of code listings in the thesis frontmatter. If all your code examples are written in the same programming language, you can use, e.g., `\lstset{language=Python}` to set the language once and for all. The code is set with the monospace font, and the font size is reduced to allow for code lines up to at least 80 characters without causing line breaks. Options for programming languages, line numbering etc. are provided. Unlike figures and tables, code listings are not floating objects, and will appear at the same position in the typeset document as in the `.tex` file. If the caption consists of a single sentence fragment (incomplete sentence), it should not be punctuated.

Code listing 2.1: Python example from file

```
import numpy as np
import matplotlib.pyplot as plt

# Comment
x = np.linspace(0, 1)
y = np.sin(2 * np.pi * x)

plt.plot(x, y)
plt.show()
```

Code listing 2.2: C++ example from file

```
#include <iostream>
using namespace std;

// No comment...
int main()
{
  cout << "Hello,␣World!" << endl;
  return 0;
}
```

Code listing 2.3: Python code in LaTeX document

```
import numpy as np
import matplotlib.pyplot as plt

x = np.linspace(0, 1)
y = np.sin(2 * np.pi * x)

plt.plot(x, y)
plt.show()
```

Code listing 2.4: C++ code in LaTeX document

```
#include <iostream>
using namespace std;

int main()
{
  cout << "Hello,␣World!" << endl;
  return 0;
}
```

2.9 Equations

Equations are typeset as normally in LaTeX. It is common to consider equations part of the surrounding sentences, and include punctuation in the equations accordingly, e.g.,

$$f(x) = \int_1^x \frac{1}{y}\,dy = \ln x\,. \tag{2.1}$$

For more advanced symbols like, e.g., $\mathbb{R}, \mathbb{Q}$, the `amssymb` package is preloaded, and for more advanced mathematical layout the `amsmath` behaviour is obtained through the `mathdesign` package. Confer the overleaf documentation for details.[4]

2.10 Fonts

Bitstream Charter at 11pt with the corresponding Mathdesign math fonts have been selected as the main fonts for the thesis template. For code examples, the monospaced font should be used – for this, a scaled version of the DejaVu-SansMono to match the main font is preselected. If you would like to use an accompanying sans serif font, the BeraSans has been made available. The standard LaTeX font commands should be used to switch between fonts, e.g., `\textit{}` *for italics*, `\textbf{}` **for bold face**, `\texttt{}` `for mono spaced`, and `\textsf{}` for sans serif. For generic *emphasis*, `\emph{}` should be applied.

2.11 Cross References

For cross references, i.e., references within the document, the `\cref{}` command provided byt the `cleveref` package should be used. Labels are inserted in the document in the standard LaTeX manner. They are case sensitive, so, e.g., a label immediately after a section command refers to that section, while a label within, e.g., a table environment refers to the table. The `\cref{}` command also generates the corresponding text. If the document is in English (class options `british` or `american`), the cross references are capitalised, whereas if it is in Norwegian (class options `norsk` or `nynorsk`), they are not. If you are writing in Norwegian, you should use `\Cref{}` at the beginning of a sentence to ensure that the cross reference is correctly capitalised. For examples on usage, see sec:crossref in chap:usage, tab:example1, fig:mapNTNU, eq:logarithm, lst:cppfile, paper:scrutiny, and app:additional. app:additional at the beginning of a sentence.

The cross references are made into active hyperlinks in the resulting PDF document by the use of the `hyperref` package. The colour of the links is set to black for best appearance on print. This can easily be changed by the author by the use of the `\hypersetup{}` command.

2.12 Glossary and Acronyms

The template comes with the ability to create a glossary and acronym list. To add entries to one of these lists, add them to the `glossary.tex` file. All uses of the acronym and glossary functions will create a clickable link that references the corresponding entry in one of the lists. All entries in the lists will also contain page references to all places it has been used.

[4] `https://www.overleaf.com/learn/latex/Mathematical_expressions`

2.12.1 Using Acronyms

To render acronyms, you have three options:

- `\acrlong{ }` prints the phrase the acronym stands for, e.g. `\acrlong{gcd}` displays gcd.
- `\acrshort{ }` prints the acronym, e.g. `\acrshort{gcd}` displays gcd.
- `\acrfull{ }` prints both the acronym and its definition, e.g. `\acrfull{gcd}` displays gcd.

2.12.2 Using Glossary

- `\gls{ }` prints the term in lowercase, e.g. `\gls{maths}` displays maths.
- `\Gls{ }` prints the term in with first letter in uppercase, e.g. `\Gls{maths}` displays maths.
- `\glspl{ }` prints the term in plural form, e.g. `\glspl{bibliography}` displays bibliography.
- `\Glspl{ }` prints the term in plural form capitalized, e.g. `\Glspl{bibliography}` displays bibliography.

2.13 Bibliography

The bibliography is typset using the `biblatex` package with the `biber` backend. The default citation style is `numeric-comp`, and the default bibliography style is `numeric`. This produces a bibliography similar to, but not completely according to, the so-called Vancouver style. With this setup, a single `\cite{}` command will give a number only [**?**], and `\textcite{}` will give author and number like this: landes1951scrutiny. If you would like to give the full reference of a paper within the thesis, e.g., in a list of included papers, use `\fullcite{}` like this: landes1951scrutiny.

2.14 Included Papers

If you are writing a compiled PhD thesis (and probably only then – see sec:compiledphd), you will need to attach the papers containing the main contribution of the thesis. This can be done issuing the `paper` environment. It takes two arguments: (i) the PDF file, and (ii) a label for cross referencing. See paper:scrutiny for an example.

2.15 Appendices

Additional material that does not fit in the main thesis but may still be relevant to share, e.g., raw data from experiments and surveys, code listings, additional plots, pre-project reports, project agreements, contracts, logs etc., can be put in appendices. Simply issue the command `\appendix` in the main `.tex` file, and then the following chapters made by `\chapter{}` become appendices. See app:additional for an example.

Chapter 3

Thesis Structure

The structure of the thesis, i.e., which chapters and other document elements that should be included, depends on several factors such as the study level (bachelor, master, PhD), the type of project it describes (development, research, investigation, consulting), and the diversity (narrow, broad). Thus, there are no exact rules for how to do it, so whatever follows should be taken as guidelines only.

A thesis, like any book or report, can typically be divided into three parts: front matter, body matter, and back matter. Of these, the body matter is by far the most important one, and also the one that varies the most between thesis types.

3.1 Front Matter

The front matter is everything that comes before the main part of the thesis. It is common to use roman page numbers for this part to indicate this. The minimum required front matter consists of a title page, abstract(s), and a table of contents. A more complete front matter, in a typical order, is as follows.

Title page: The title page should, at minimum, include the thesis title, authors and a date. A more complete title page would also include the name of the study programme, and possibly the thesis supervisor(s). See sec:setup.

Abstracts: The abstract should be an extremely condensed version of the thesis. Think one sentence with the main message from each of the chapters of the body matter as a starting point. landes1951scrutiny have given some very nice instructions on how to write a good abstract. A thesis from a Norwegian Univeristy should contain abstracts in both Norwegian and English irrespectively of the thesis language (typically with the thesis language coming first).

Dedication: If you wish to dedicate the thesis to someone (increasingly common with increasing study level), you may add a separate page with a dedication here. Since a dedication is a personal statement, no template is given. Design it according to your preference.

Acknowledgements: If there is someone who deserves a 'thank you', you may add acknowledgements here. If so, make it an unnumbered chapter, i.e., `\chapter*{Acknowledgements}`.

Table of contents: A table of contents should always be present in a document at the size of a thesis. It is generated automatically using the `\tableofcontents` command. The one generated by this document class also contains the front matter and unnumbered chapters.

List of figures: If the thesis contains many figures that the reader might want to refer back to, a list of figures can be included here. It is generated using `\listoffigures`.

List of tables: If the thesis contains many tables that the reader might want to refer back to, a list of tables can be included here. It is generated using `\listoftables`.

List of code listings: If the thesis contains many code listings that the reader might want to refer back to, a list of code listings can be included here. It is generated using `\lstlistoflistings`.

Other lists: If there are other list you would like to include, this would be a good place. Examples could be lists of definitions, theorems, nomenclature, abbreviations, glossary etc. There are no standards for this, but many lists can be generated using the `description` environment (like, e.g., this list of possible front matter content) within a separate `\chapter*{}`.

Preface or Foreword: A preface or foreword is a good place to make other personal statements that do not fit whithin the body matter. This could be information about the circumstances of the thesis, your motivation for choosing it, or possibly information about an employer or an external company for which it has been written. Again, use, e.g., `\chapter*{Preface}`.

3.2 Body Matter

The body matter consists of the main chapters of the thesis. It starts the Arabic page numbering with page 1. There is a great diversity in the structure chosen for different thesis types. Common to almost all is that the first chapter is an introduction, and that the last one is a conclusion followed by the bibliography.

3.2.1 Development Project

For many bachelor and some master projects in computer science, the main task is to develop something, typically a software prototype, for an 'employer' (e.g., an external company or a research group). A thesis describing such a project is typically structured as a software development report whith more or less the following chapters:

Introduction: The introduction of the thesis should take the reader all the way from the big picture and context of the project to the concrete task that has been solved in the thesis. A nice skeleton for a good introduction was given by claerbout1991scrutiny: *review–claim–agenda*. In the review part, the background of the project is covered. This leads up to your claim, which is typically that some entity (software, device) or knowledge (research questions) is missing and sorely needed. The agenda part briefly summarises how your thesis contributes.

Requirements: The requirements chapter should lead up to a concrete description of both the functional and non-functional requirements for whatever is to be developed at both a high level (use cases) and lower levels (low level use cases, requirements). If a classical waterfall development process is followed, this chapter is the product of the requirement phase. If a more agile model like, e.g., SCRUM is followed, the requirements will appear through the project as, e.g., the user stories developed in the sprint planning meetings.

Technical design: The technical design chapter describes the big picture of the chosen solution. For a software development project, this would typically contain the system arcitechture (client-server, cloud, databases, networking, services etc.); both how it was solved, and, more importantly, why this architecture was chosen.

Development Process: In this chapter, you should describe the process that was followed. It should cover the process model, why it was chosen, and how it was implemented, including tools for project management, documentation etc. Depending on how you write the other chapters, there may be good reasons to place this chapters somewhere else in the thesis.

Implementation: Here you should describe the more technical details of the solution. Which tools were used (programming languages, libraries, IDEs, APIs, frameworks, etc.). It is a good idea to give some code examples. If class diagrams, database models etc. were not presented in the technical design chapter, they can be included here.

Deployment: This chapter should describe how your solution can be deployed on the employer's system. It should include technical details on how to set it up, as well as discussions on choices made concerning scalability, maintenance, etc.

Testing and user feedback: This chapter should describe how the system was tested during and after development. This would cover everything from unit testing to user testing; black-box vs. white-box; how it was done, what was learned from the testing, and what impact it had on the product and process.

Discussion: Here you should discuss all aspect of your thesis and project. How did the process work? Which choices did you make, and what did you learn from it? What were the pros and cons? What would you have done differently if you were to undertake the same project over again, both in terms of process and product? What are the societal consequences of your work?

Conclusion: The conclusion chapter is usually quite short – a paragraph or two – mainly summarising what was achieved in the project. It should answer the *claim* part of the introduction. It should also say something about what comes next ('future work').

Bibliography: The bibliography should be a list of quality-assured peer-reviewed published material that you have used throughout the work with your thesis. All items in the bibliography should be referenced in the text. The references should be correctly formatted depending on their type (book, journal article, conference publication, thesis etc.). If `biblatex` is correctly used as proposed by this template, the formatting will be taken care of automatically. The bibliography should not contain links to arbitrary dynamic web pages where the content is subject to change at any point of time. Such links, if necessary, should rather be included as footnotes throughout the document. The main point of the bibliography is to back up your claims with quality-assured material that future readers will actually be able to retrieve years ahead.

3.2.2 Research Project

For many master and some bachelor projects in computer science, the main task is to gain knew knowledge about something. A thesis describing such a project is typically structed as an extended form of a scientific paper, following the so-called IMRaD (Introduction, Method, Results, and Discussion) model:

Introduction: See sec:development.

Background: Research projects should always be based on previous research on the same and/or related topics. This should be described as a background to the thesis with adequate bibliographical references. If the material needed is too voluminous to fit nicely in the review part of the introduction, it can be presented in a separate background chapter.

Method: The method chapter should describe in detail which activities you undertake to answer the research questions presented in the introduction, and why they were chosen. This includes detailed descriptions of experiments, surveys, computations, data analysis, statistical tests etc.

Results: The results chapter should simply present the results of applying the methods presented in the method chapter without further ado. This chapter will typically contain many graphs, tables, etc. Sometimes it is natural to discuss the results as they are presented, combining them into a 'Results and Discussion' chapter, but more often they are kept separate.

Discussion: See sec:development.

Conclusion: See sec:development.

Bibliography: See sec:development.

3.2.3 Monograph PhD Thesis

Traditionally, it has been common to structure a PhD thesis as a single book – a *monograph*. If the thesis is in the form of one single coherent research project, it can be structured along the lines of sec:resesarch. However, for such a big work that a PhD thesis constitutes, the tasks undertaken are often more diverse, and thus more naturally split into several smaller research projects as follows:

Introduction: The introduction would serve the same purpose as for a smaller research project described in sec:development, but would normally be somewhat more extensive. The *agenda* part should inform the reader about the structure of the rest of the document, since this may vary significantly between theses.

Background: Where as background chapters are not necessarily needed in smaller works, they are almost always need in PhD thesis. They may even be split into several chapters if there are significantly different topics to cover. See sec:resesarch.

Main chapters: Each main chapter can be structured more or less like a scientific paper. Depending on how much is contained in the introduction and background sections, the individual introduction and background sections can be significantly reduced or even omitted completely.

- (Introduction)
- (Background)

- Method
- Results
- Discussion
- Conclusion

Discussion: In addition to the discussions within each of the individual chapters, the contribution of the thesis *as a whole* should be thoroughly discussed here.

Conclusion: In addition to the conclusions of each of the individual chapters, the overall conclusion of the thesis, and how the different parts contribute to it, should be presented here. The conclusion should answer to the research questions set out in the main introduction. See also sec:development.

Bibliography: See sec:development.

3.2.4 Compiled PhD Thesis

Instead of writing up the PhD thesis as a monograph, compiled PhD theses (also known as stapler theses, sandwich theses, integrated theses, PhD by published work) consisting of reproductions of already published research papers are becoming increasingly common. At least some of the papers should already have been accepted for publication at the time of submission of the thesis, and thus have been through a real quality control by peer review.

Introduction: See sec:monograph.

Background: See sec:monograph.

Main contributions: This chapter should sum up *and integrate* the contribution of the thesis as a whole. It should not merely be a listing of the abstracts of the individual papers – they are already available in the attached papers, and, as such, not needed here.

Discussion: See sec:monograph.

Conclusion: See sec:monograph.

Bibliography: See sec:development.

Paper I: First included paper with main contributions. It can be included verbatim as a PDF. The publishers PDF should be used if the copyright permits it. This should be checked with the SHERPA/RoMEO database[1] or with the publisher. Even when it is no general permission by the publisher, you may write and ask for one.

Paper II: etc.

[1] `http://sherpa.ac.uk/romeo/index.php`

3.3 Back Matter

Material that does not fit elsewhere, but that you would still like to share with the readers, can be put in appendices. See app:additional.

Chapter 4

Conclusion

You definitely should use the `ntnuthesis` LaTeX document class for your thesis.

Bibliography

[heading=none]

Paper I

paper]paper:scrutiny Here, you may add a description of the paper, an illustration, or just give the bibliographic reference:

landes1951scrutiny

Or you may leave it empty, if you like.

BULLETIN OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
VOL. 50, NO. 9 (SEPTEMBER, 1966), P. 1992-1999, 2 FIGS.

GEOLOGICAL NOTES

A SCRUTINY OF THE ABSTRACT, II[1]

KENNETH K. LANDES[2]
Ann Arbor, Michigan

ABSTRACT

A partial biography of the writer is given. The inadequate abstract is discussed. What should be covered by an abstract is considered. The importance of the abstract is described. Dictionary definitions of "abstract" are quoted. At the conclusion a revised abstract is presented.

For many years I have been annoyed by the inadequate abstract. This became acute while I was serving a term as editor of the *Bulletin* of The American Association of Petroleum Geologists. In addition to returning manuscripts to authors for rewriting of abstracts, I also took 30 minutes in which to lower my ire by writing, "A Scrutiny of the Abstract."[1] This little squib has had a fantastic distribution. If only one of my scientific outpourings would do as well! Now the editorial board of the Association has requested a revision. This is it.

The inadequate abstract is illustrated at the top of the page. The passive voice is positively screaming at the reader! It is an outline, with each item in the outline expanded into a sentence. The reader is told what the paper is about, but not what it contributes. Such abstracts are merely overgrown titles. They are produced by writers who are either (1) beginners, (2) lazy, or (3) have not written the paper yet.

To many writers the preparation of an abstract is an unwanted chore required at the last minute by an editor or insisted upon even before the paper has been written by a deadline-bedeviled program chairman. However, in terms of market reached, the abstract is *the most important part of the paper*. For every individual who reads or listens to your entire paper, from 10 to 500 will read the abstract.

If you are presenting a paper before a learned society, the abstract alone may appear in a preconvention issue of the society journal as well as in the convention program; it may also be run by trade journals. The abstract which accompanies a published paper will most certainly reappear in abstract journals in various languages, and perhaps in company internal circulars as well. It is much better to please than to antagonize this great audience. Papers written for oral presentation should be *completed prior to the deadline for the abstract*, so that the abstract can be prepared from the written paper and not from raw ideas gestating in the writer's mind.

My dictionary describes an abstract as "a summary of a statement, document, speech, etc. . . ." and that which *concentrates in itself the essential information* of a paper or article. The definition I prefer has been set in italics. May all writers learn the art (it is not easy) of preparing an abstract containing the *essential information* in their compositions. With this goal in mind, I append an abstract that should be an improvement over the one appearing at the beginning of this discussion.

ABSTRACT

The abstract is of utmost importance, for it is read by 10 to 500 times more people than hear or read the entire article. It should not be a mere recital of the subjects covered. Expressions such as "is discussed" and "is described" should *never* be included! The abstract should be a condensation and concentration of the *essential information* in the paper.

[1] Revised from K. K. Landes' "A Scrutiny of the Abstract," first published in the *Bulletin* in 1951 (*Bulletin,* v. 35, no. 7, p. 1660). Manuscript received, June 3, 1966; accepted, June 10, 1966.

Editor's note: this abstract is published together with The Royal Society's "Guide for Preparation and Publication of Abstracts" to give *Bulletin* authors two viewpoints on the writing of abstracts.

[2] Professor of geology and mineralogy, University of Michigan. Past editor of the *Bulletin.*

Appendix A

Additional Material

Additional material that does not fit in the main thesis but may still be relevant to share, e.g., raw data from experiments and surveys, code listings, additional plots, pre-project reports, project agreements, contracts, logs etc., can be put in appendices. Simply issue the command `\appendix` in the main `.tex` file, and make one chapter per appendix.

If the appendix is in the form of a ready-made PDF file, it should be supported by a small descriptive text, and included using the `pdfpages` package. To illustrate how it works, a standard project agreement (for the IE faculty at NTNU in Gjøvik) is attached here. You would probably want the included PDF file to begin on an odd (right hand) page, which is achieved by using the `\cleardoublepage` command immediately before the `\includepdf[]{}` command. Use the option `[pages=-]` to include all pages of the PDF document, or, e.g., `[pages=2-4]` to include only the given page range.

NTNU

Vår dato Vår referanse

Norges teknisk-naturvitenskapelige universitet

Prosjektavtale

mellom NTNU Fakultet for informasjonsteknologi og elektroteknikk (IE) på Gjøvik (utdanningsinstitusjon), og

____

____ (oppdragsgiver), og

____

____

____ (student(er))

Avtalen angir avtalepartenes plikter vedrørende gjennomføring av prosjektet og rettigheter til anvendelse av de resultater som prosjektet frembringer:

1. Studenten(e) skal gjennomføre prosjektet i perioden fra ____________ til______________ .

   Studentene skal i denne perioden følge en oppsatt fremdriftsplan der NTNU IE på Gjøvik yter veiledning. Oppdragsgiver yter avtalt prosjektbistand til fastsatte tider. Oppdragsgiver stiller til rådighet kunnskap og materiale som er nødvendig for å få gjennomført prosjektet. Det forutsettes at de gitte problemstillinger det arbeides med er aktuelle og på et nivå tilpasset studentenes faglige kunnskaper. Oppdragsgiver plikter på forespørsel fra NTNU å gi en vurdering av prosjektet vederlagsfritt.

2. Kostnadene ved gjennomføringen av prosjektet dekkes på følgende måte:
   - Oppdragsgiver dekker selv gjennomføring av prosjektet når det gjelder f.eks. materiell, telefon/fax, reiser og nødvendig overnatting på steder langt fra NTNU på Gjøvik. Studentene dekker utgifter for ferdigstillelse av prosjektmateriell.
   - Eiendomsretten til eventuell prototyp tilfaller den som har betalt komponenter og materiell mv. som er brukt til prototypen. Dersom det er nødvendig med større og/eller spesielle investeringer for å få gjennomført prosjektet, må det gjøres en egen avtale mellom partene om eventuell kostnadsfordeling og eiendomsrett.

3. NTNU IE på Gjøvik står ikke som garantist for at det oppdragsgiver har bestilt fungerer etter hensikten, ei heller at prosjektet blir fullført. Prosjektet må anses som en eksamensrelatert oppgave som blir bedømt av intern og ekstern sensor. Likevel er det en forpliktelse for utøverne av prosjektet å fullføre dette til avtalte spesifikasjoner, funksjonsnivå og tider.

4. Alle bacheloroppgaver som ikke er klausulert og hvor forfatteren(e) har gitt sitt samtykke til publisering, kan gjøres tilgjengelig via NTNUs institusjonelle arkiv hvis de har skriftlig karakter A, B eller C.

Tilgjengeliggjøring i det åpne arkivet forutsetter avtale om delvis overdragelse av opphavsrett, se «avtale om publisering» (jfr Lov om opphavsrett). Oppdragsgiver og veileder godtar slik offentliggjøring når de signerer denne prosjektavtalen, og må evt. gi skriftlig melding til studenter og instituttleder/fagenhetsleder om de i løpet av prosjektet endrer syn på slik offentliggjøring.

Den totale besvarelsen med tegninger, modeller og apparatur så vel som programlisting, kildekode mv. som inngår som del av eller vedlegg til besvarelsen, kan vederlagsfritt benyttes til undervisnings- og forskningsformål. Besvarelsen, eller vedlegg til den, må ikke nyttes av NTNU til andre formål, og ikke overlates til utenforstående uten etter avtale med de øvrige parter i denne avtalen. Dette gjelder også firmaer hvor ansatte ved NTNU og/eller studenter har interesser.

5. Besvarelsens spesifikasjoner og resultat kan anvendes i oppdragsgivers egen virksomhet. Gjør studenten(e) i sin besvarelse, eller under arbeidet med den, en patentbar oppfinnelse, gjelder i forholdet mellom oppdragsgiver og student(er) bestemmelsene i Lov om retten til oppfinnelser av 17. april 1970, §§ 4-10.

6. Ut over den offentliggjøring som er nevnt i punkt 4 har studenten(e) ikke rett til å publisere sin besvarelse, det være seg helt eller delvis eller som del i annet arbeide, uten samtykke fra oppdragsgiver. Tilsvarende samtykke må foreligge i forholdet mellom student(er) og faglærer/veileder for det materialet som faglærer/veileder stiller til disposisjon.

7. Studenten(e) leverer oppgavebesvarelsen med vedlegg (pdf) i NTNUs elektroniske eksamenssystem. I tillegg leveres ett eksemplar til oppdragsgiver.

8. Denne avtalen utferdiges med ett eksemplar til hver av partene. På vegne av NTNU, IE er det instituttleder/faggruppeleder som godkjenner avtalen.

9. I det enkelte tilfelle kan det inngås egen avtale mellom oppdragsgiver, student(er) og NTNU som regulerer nærmere forhold vedrørende bl.a. eiendomsrett, videre bruk, konfidensialitet, kostnadsdekning og økonomisk utnyttelse av resultatene. Dersom oppdragsgiver og student(er) ønsker en videre eller ny avtale med oppdragsgiver, skjer dette uten NTNU som partner.

10. Når NTNU også opptrer som oppdragsgiver, trer NTNU inn i kontrakten både som utdanningsinstitusjon og som oppdragsgiver.

11. Eventuell uenighet vedrørende forståelse av denne avtale løses ved forhandlinger avtalepartene imellom. Dersom det ikke oppnås enighet, er partene enige om at tvisten løses av voldgift, etter bestemmelsene i tvistemålsloven av 13.8.1915 nr. 6, kapittel 32.

12. Deltakende personer ved prosjektgjennomføringen:

NTNUs veileder (navn): ____

Oppdragsgivers kontaktperson (navn): ____

Student(er) (signatur): ____ dato ____________

____ dato ____________

____ dato ____________

____ dato ____________

Oppdragsgiver (signatur):____ dato ____________

Signert avtale leveres digitalt i Blackboard, rom for bacheloroppgaven.
Godkjennes digitalt av instituttleder/faggruppeleder.

Om papirversjon med signatur er ønskelig, må papirversjon leveres til instituttet i tillegg.
Plass for evt sign:

Instituttleder/faggruppeleder (signatur): _____________________________________ dato ____________