

User guides

Master's Programmes in Computer Science and Data Science

Guide for the CS and DS master's thesis template V-1.0

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Tiivistelmä — Sammanfattning — Abstract

This document provides instructions for using the thesis template of the Master's Programmes in Computer Science and Data Science. In addition, this guide and its source code contain tips for writing with LaTeX. Finally, instructions are provided for producing an accessible PDF file.

ACM Computing Classification System (CCS)
General and reference → Document types → Surveys and overviews
Applied computing → Document management and text processing → Document management → Text editing

Avainsanat — Nyckelord — Keywords

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Chapter 1

Guide for using the template

This document provides instructions on how to write your master's thesis using the template while ensuring the accessibility of the produced PDF file. Note that detailed instructions are embedded in the comments (prefixed with %) of the template source code, so make sure to read the code, too. Note also that the text contains some links to different guidelines or web pages. You can see the links both in the source code and in the compiled document.

Chapter 2

Setting up the template

In this chapter, we go through different steps in setting up the template. There are four phases: copying the template, selecting the degree programme and the language of the thesis, specifying the thesis title, personal information, keywords and abstract, as well as writing the thesis.

2.1 Step 1: Copy the thesis template

The recommended method is to copy the thesis template into a new Overleaf project. The easiest way to do this is:

- Go to www.overleaf.com/edu/helsinki and sign in to Overleaf with your university credentials (SSO login).
- Copy the thesis template: https://www.overleaf.com/read/kgxvsnrdddyj#11a9f0. See the instructions for copying a project at https://docs.overleaf.com/managing-projects-and-files/copying-a-project.
- After this, you are ready to start exploring and using the template. As a first step, it is recommended to rename the project, e.g., to "Lastname-Firstname".
- **Note!** The template is designed to be used with the LuaLaTeX compiler. Make sure the correct compiler is set in the Overleaf menu File → Settings → Compiler.

An alternative approach for those using a local LaTeX installation is to download the template as a zip file from Overleaf and extract it into suitable directory. In this case,

make sure that the template compiles without issues. It is recommended to use a current LaTeXRelease (LaTeX 2025-11-01 or newer) and to use the Unicode engine luaLaTeX instead of pdfLaTeX.

2.2 Step 2: Select the degree programme and the language of the thesis

First, specify the language of your document in the metadata (at the beginning of the file `UH-MSc-CS-DS-main.tex` in the `\DocumentMetadata` command) by setting the `lang` field to `fi`, `sv` or `en`.

Continue by selecting the appropriate options for the language and degree programme for the `\documentclass` command. The template supports the following degree programmes:

- Master's Programme in Computer Science (`csm`), and
- Master's Programme in Data Science (`dsm`).

Choose also the option for the thesis language: `finnish`, `english`, or `swedish`.

2.3 Step 3: Specify the thesis title, personal information, keywords, and abstract

Provide suitable (preliminary) information in the following commands:

- Thesis title: `\title{}`.
- Author's name: `\author{}`.
- Supervisor(s) name(s) and academic title(s): `\supervisors{}`.
- Keywords: `\keywords{}`.
- ACM classification terms: `\classification{}` (more information about the classification is available at https://dl.acm.org/ccs) and
- Abstract: `\mscabstract{}`.

You will probably return to update these during the thesis process.

If you need the abstract or some other part of the text in a different language, see Section 4.1 for how to set another language for a part of the document.

2.4 Step 4: Write the thesis

Now, you only need to do all the work, i.e., write the thesis. The following chapters provide some practical LaTeX tips and instructions on producing an accessible PDF. The process of writing a master's thesis and producing scientific text using LaTeX is discussed more broadly, e.g., in the materials of the Bachelor's thesis seminar and the Master's thesis seminar.

Note that for a master's thesis, the chapter titles *Introduction*, *Conclusions*, and *Use of AI in the thesis* are fixed and provided in the template. Do not edit these when writing your thesis.

Chapter 3

Mandatory sections in a master's thesis

Every master's thesis must include a (unnumbered) section in the *Conclusions* chapter describing the use of artificial intelligence in the thesis. For more information on this, see file `Ch.40_Conclusions.tex`.

A very small group of students must include an additional extended summary in the language of their secondary education into the master' thesis. This is required if **all** the following conditions hold:

1. The student has completed the bachelor's degree outside Finland.
2. The student's language of secondary education is Finnish or Swedish.
3. The thesis is written in a language other than the student's language of secondary education.

If all the above conditions are met, please refer to the file `Ch.01_ExtendedAbstract.tex` and its instructions. For most students, a separate extended abstract is not required. The extended abstract is added after the abstract page, before the table of contents.

Chapter 4

Hints for writing in LaTeX

Detailed LaTeX instructions can be best found through online searches (AI tools may also helpful). For example, searching for "Overleaf table positioning" will likely provide a useful answer. Overleaf provides extensive LaTeX tutorials and documentation (https://www.overleaf.com/learn).

4.1 Setting another language for a part of the thesis

If you need to typeset your abstract or some other section in a language different from the primary thesis language, you can set the language using the `otherlanguage` environment. The following is a small example of the usage of this environment:

```
First, the text is in Finnish.
\begin{otherlanguage}{finnish}
Suomenkielinen teksti kirjoitetaan tähän.
\end{otherlanguage}
After this, the text continues in English.
```

This ensures, e.g., correct hyphenation of the text.

4.2 Bibliography style

The default style in the template is the APA style (an author-year citation style). An example of a citation is citation (Einstein, 1905).

For your master's theses, you may agree on a different style with your supervisor. Information on different styles you can find, e.g., from the Overleaf's BibLaTeX guide at https://www.overleaf.com/learn/latex/Biblatex_bibliography_styles. By choosing suitable BibLaTeX options in `UH-MSc-CS-DS-main.tex`, you can easily switch the citation style to, e.g., numeric [1] or alphabetic [Ein05].

4.3 Citations in LaTeX

Bibliographic information is stored in a separate .bib text file. In this template, the bibliographic entries are in the file called `bibliography.bib`.

When using the APA style, citations are typically created with `\parencite{einstein}`, which produces a citation formatted as (Einstein, 1905). See in the list of references, how the information of the source article looks like. Correspondingly, citation (Knuth, 1999; Mittelbach et al., 2004) is generated with `\parencite{latexcompanion,knuth99}`. This gives you the opportunity to cite several sources at the same time.

There are many citation commands, which are especially useful in the author-year styles. For example, you can write that Einstein (1905) discovered something, referring to the author Einstein and publication year 1905, assuming the entry with key `einstein` exists correctly in your .bib file (see theLaTeXsource code for details). You find a list of different citation commands, e.g., in the BibLaTeX cheatsheet of Comprehensive TEX Archive Network team at https://tug.ctan.org/info/biblatex-cheatsheet/biblatex-cheatsheet.pdf.

Only the sources cited in the text appear in the bibliography automatically. Hence, extra entries in the .bib file do not matter. The accuracy and consistency of bibliographic information in the .bib file affect how the reference appears in the thesis and in the list of references. Note that BibTeX data found online (e.g., in Google Scholar or some publisher's sites) are often incomplete or inconsistent. The author of the text is always responsible for the completeness of the references, even if some reference management tool is used.

You find examples of the most common BibTeX entry types from the `bibliography.bib` file:

`@book` – book, e.g. (Goodfellow et al., 2016; Knuth, 1999; Mittelbach et al., 2004),

`@article` – journal article, e.g. (Einstein, 1905; Janzen & Saiedian, 2005),

`@inproceedings` – article in conference proceedings, e.g., (Hilton et al., 2016),



Figure 4.1: University of Helsinki logo in the Faculty of Science colour.

`@online` – online material, e.g., (Knuth, n.d.), and

`@misc` – miscellaneous materials not fitting to any other category, e.g., (Toivonen et al., 2026).

See from the .bib file what information is provided for different entry types. Note also that there are fields whose information is not shown in the list of references.

4.4 Figures

Figure 4.1 shows an example of including a figure into the thesis (see the LaTeX source for details). Each figure must have a caption. Always refer to each figure in the text. Check also that in the final thesis you refer to every figure for the first time in the text before the figure itself or at least on the same page with it.

For accessibility (see more on this in Chapter 5), every figure must also have an alt-text (see the source code for an example of this). A visually impaired reader may rely on a screen reader, which will read the alt-text instead of showing the image. For advice on writing good alt-text, see, e.g., the Harvard University guidelines (https://accessibility.huit.harvard.edu/describe-content-images).

4.5 Tables

Table 4.1 shows an example of reporting experimental results. Always refer to each table in the text. As in the case of figures, check also that in the final thesis you refer to every table for the first time in the text before the table itself or at least on the same page with it.

This template uses the `booktabs` package. See the details of it and its usage from the `Booktabs` documentation at https://ctan.org/pkg/booktabs.

Accessibility of tables can be improved by designing a clear table structure. Screen readers struggle when a table contains visually grouped information spanning multiple rows. To ensure accessibility, specify explicitly which table rows/columns are headers. See the source code relate to Table 4.1 for an example how this can be done.

4.6 Lists

In the source code of this document you can find examples of three different list environments (`itemize`, `enumerate` and `description`). Several list with bullet points (`itemize`) you can find in Chapter 2, one numerated list (`enumerate`) in Chapter 3 and a definition type of a list (`description`) in Section 4.3.

Table 4.1: Experimental results. For each experiment A, B, and $A+B$, the running times of three separate stages are reported in seconds.

Experiment	Stage 1	Stage 2	Stage 3
A	2.5	4.7	11.4
B	8.0	3.7	12.6
$A + B$	10.5	1.0	1.6

Chapter 5

Accessibility

The EU directive on the accessibility of websites and mobile applications (Directive (EU) 2016/2102) requires that materials on public websites are accessible. This also applies to theses, as they are public documents (Act on the Openness of Government Activities, 21.5.1999/621). Accessibility means considering possible functional limitations of users, including the use of screen readers. This template aims to produce PDF files that are as accessible as possible. Concretely, this means they contain the structural information required by assistive technologies to read the document aloud or present it in braille. Note that accessibility is much broader concept than structural tagging, so ensuring the accessibility of the content remains primarily on the author's responsibility.

Although LaTeX files contain a lot of structured information, PDF files produced with LaTeX are not accessible by default. This problem has been addressed in recent years in the LaTeXTagging Project(https://latex3.github.io/tagging-project/) and in March 2026 the PDF Association published a news (https://pdfa.org/accessible-math-in-pdf-finally/) that it is finally possible to produce accessible PDF files with LaTeX, which also contain mathematical notation and formulas. It is worth to read the user instructions found in the documentation section of the LaTeXTagging Project (https://latex3.github.io/tagging-project/documentation/usage-instructions), and for those interested, there is also an even more extensive guide on accessibility at https://latex3.github.io/tagging-project/documentation/wtpdf/fulldoc.

The accessibility of this template has been tested using the NVDA screen reader with Windows and Adobe Acrobat Reader. See the instructions of the University of Helsinki Helpdesk for accessibility testing with screen readers at https://helpdesk.it.helsinki.fi/en/instructions/other-instructions/accessibility-testing-screen-readers. Note that NVDA re-

quires an add-on to be able to read mathematical expressions. We used MathCAT (https://addons.nvda-project.org/addons/MathCAT.en.html) in testing of this template.

Information on the accessibility of PDF files be found in the PDF Association's press release at https://pdfa.org/accessible-math-in-pdf-finally/. This template has been verified to comply with PDF/UA-2, PDF/A-4f[1], ISO 32005 and WTPDF 1.0 standards using the OctoPDF[2] and Pdf4wcag[3] tools. The WCAG 2.2 standard is not yet fully achieved (the PDF contains some empty structural elements and the URL in the contact information page lacks an alternative description, as will any possible URLs in references lack, too). The interpretation of mathematical notation (MathML content) may not always be optimal for screen readers. This situation is expected to improve in the near future as accessible documents containing MathML become more common.

It is also worth noting that all images and tables appear last in the reading order for screen readers, regardless of their position in the document (this is a feature, not a bug per se). Their position in the reading order may potentially be affected by the h option of the figure environment (not tested).

How to ensure that your thesis is accessible?

1. Use this template and follow its instructions.
2. If you add new LaTeX packages, check their compatibility status from the LaTeX Tagging Project listing (https://latex3.github.io/tagging-project/tagging-status/).
3. Use the structural elements in LaTeX (chapters, sections, lists, etc.) logically.
4. Do not make any cross-references manually (use the `\label{} and \ref{}` commands, and for citations, `\parentcite{}` or other variants).
5. Add descriptive alt-text to every figure and ensure visual accessibility.
6. For each table, specify the header rows/columns and aim for a clear logical structure.
7. Test the accessibility of your final thesis. Note that the functionality and availability of tools vary. You can test the accessibility of PDFs, for example,

[1] Note that the color profile of the template is set to RGB and the PDF/A-4f standard will be broken if you add images produced with the CYMK color profile to your thesis.
[2] https://octopdf.com
[3] https://pdf4wcag.com

- with online tools, e.g. OctoPDF[4] or Pdf4wcag[5] (more hints on the tools can be found in the PDF-Association's press release (https://pdfa.org/accessible-math-in-pdf-finally/)[6],
- with Adobe Acrobat Pro/DC (not free), or
- with PAC accessibility tool (https://pac.pdf-accessibility.org/en; free, only available for Windows).

Screen readers are available for different operating systems (see the University of Helsinki Helpdesk instructions at https://helpdesk.it.helsinki.fi/help/20057 and the LaTeX Tagging project instructions at https://latex3.github.io/tagging-project/documentation/wtpdf/fulldoc), but their functionality with MathML varies greatly (NVDA with the MathCAT extension worked quite well in testing).

[4] https://octopdf.com
[5] https://pdf4wcag.com
[6] Note that when using online tools, you will have to upload your files to the tool's server.

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