Lecture 11
Theses and Papers

Prof. Dr. Jasmin Blanchette

Chair of Theoretical Computer Science and
Theorem Proving

Version of July 1, 2025

Bachelor's and Master's Theses

The Target Audience

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Thus, you need to explain the **fundamental concepts** behind your work that are not part of the curriculum. For example, if your project was to develop a compiler, you should briefly define and explain the different compiler phases.

The Title

As a rule, the title of a thesis should be **informative** rather than catchy.
It should capture your contribution precisely without being too long—e.g.:

Benchmarking of Quantum Generative AI Models
Strategies and Optimization Approaches for Exchanging Clauses in SAT Solvers
Haskell for Natural Language Processing: A Comprehensive Survey

The Abstract

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The best abstracts are concrete.

The abstract should not contain citations.
If unavoidable, refer to sources by naming the authors.

The Acknowledgment

Most theses include an acknowledgment at the beginning.
This is where you **thank** your supervisors followed by anyone else who helped you with your research project or your thesis
(e.g., friends or fellow students who read your text).

The Table of Contents

In computer science, tables of contents tend to have a **hybrid** structure:

- The outer chapters or sections have conventional titles—e.g., *Introduction*, *Preliminaries*, *Discussion*, *Conclusion*.
- The core chapters or sections have custom titles—e.g., *Design of the Garbage Collector*.

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A bachelor's thesis usually consists of **sections**.
A master's thesis may consist of **chapters** or **sections**.
Chapters may consist of multiple sections,
and sections may consist of multiple subsections.

The Table of Contents

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Two approaches:

1. Introduction
2. Related Work
3. Preliminaries

   Core chapters or sections

n. Conclusion

1. Introduction
2. Preliminaries

   Core chapters or sections

$n-1$. Related Work

n. Conclusion

With the second approach, some related work might need to be discussed earlier, if the thesis builds on it.

The Table of Contents

Advantages of early placement of related work:

- The related work is **coherently located** at the thesis's beginning.
  instead of being distributed over the thesis.
- You can **refer** to the related work from the thesis's core.
- You can use the related work to identify a **research gap** or **open question** motivating your own work.

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Advantages of late placement of related work:

- You can **focus first on your own work**.
- You can discuss the related work **in more depth** with respect to your own work.

Example of a Table of Contents

The Introduction

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Ways to achieve this:

- **State of the art vs. contribution**: You start by explaining the state of the art in your field. Do not hesitate to use the term *state of the art* to make this completely unambiguous for the reader. You then summarize your contribution. Do not hesitate to write *contribution* to make this clear.

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- **Problem vs. solution**: You start by presenting a problem. You then present your solution to the problem. Do not hesitate to use the terms *problem* and *solution* to make things clear.

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You can combine either approach with an **opening hook**.

The Introduction

When explaining the motivation for your work, focus on the **science**, not the metascience. Instead of writing

> *In recent years, an increasing number of computer scientists have turned their attention to the problem of explainable artificial intelligence.*

or

> *Explainable artificial intelligence is an important research topic.*

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If you have **research questions**, ask them in the introduction,
then answer them in the thesis's body.

The Preliminaries or Background

Early in your thesis, you will likely have a chapter or section called *Preliminaries* or *Background*. Some authors make this distinction:

- **Preliminaries** are basic definitions, notations, and other conventions that are used in the rest of the thesis.
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- **Background** is related work on which your thesis builds.

You should define or explain any **specialized terms** that might be unfamiliar to your target audience. When in doubt, briefly summarize the important concepts.
For simple definitions and theorems, one or two sentences are often sufficient.
For more complex concepts, you might want to write a full paragraph.

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Some theses have a separate chapter or section titled *Discussion*, where **results are analyzed**. You can also inline such discussion throughout the thesis.

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You may feel that there is no or little related work to write about.
But if you broaden the definition of "related," you will **find something**.
Your supervisors should be able to help.

The Conclusion

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The conclusion can be short. **One** or **two pages** might suffice. To quote Paulson: "A page of ramblings about everything you might do in the next five years, or would do if you had your time again, belongs on your blog."

Examples of Theses

Let us look at a bachelor's and a master's thesis:

- Matthias Kettl, "**Fault Localization for Formal Verification: An Implementation and Evaluation of Algorithms Based on Error Invariants and UNSAT-Cores**," bachelor's thesis, Ludwig-Maximilians-Universität München, 2020.
- Wanja Sajko, "**Exploring the Potential of the Filtering Variational Quantum Eigensolver**," master's thesis, Ludwig-Maximilians-Universität München, 2023.

PhD Theses

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  The introduction might be 5 pages long, the background 10 pages long, and the conclusion 2 or 3 pages long. Core chapters are likely to be at least 15 pages long, each corresponding roughly to a research paper.

Acknowledgment of Coauthorship

Often PhD research is carried out in **collaboration** with coauthors.
The precise contributions of each author must be acknowledged in the introduction, the individual chapters, or an appendix.

Examples of Theses

Let us look at a cumulative and a noncumulative PhD thesis:

- Maximilian Bernhard, **Deep Learning Methods for Image Recognition in Remote Sensing**, PhD thesis, Ludwig-Maximilians-Universität München, 2024.
- Sophia Elisabeth Grundner-Culemann, **Formal Verification of Revocation Approaches in Identity-Based Cryptography**, PhD thesis, Ludwig-Maximilians-Universität München, 2024.

Research Papers

Workshops, Conferences, and Journals

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Workshop and conference papers are published in **proceedings**.

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The main advantage of workshops and conferences is that you can **advertise** your research by giving a talk at an in-person event.

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Journal articles can be up to about 100 pages long,
which makes them suitable for publishing more **detailed accounts**.
Many journal articles are extended versions of conference papers.

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As Paulson remarked: “Finally you get to describe your actual work. Are you on page 2 or page 7? If the latter, how did you manage to use half of your page allowance before saying anything original?”

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Reviews usually include a summary, an assessment, a recommendation (e.g., "weak accept"), and a confidence level (e.g., "expert"). Often, reviewers also ask you questions and make suggestions to improve your paper.

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At some conferences, papers may be accepted conditionally.
Such papers are assigned a **shepherd**, who guides you through their revisions.

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Some publishers work directly with the LaTeX sources.
Others import the papers into some proprietary tool.
Either way, the publisher might introduce typesetting errors during copy editing.
Fortunately, you get to check **galley proofs** before publication.

Example of Correspondence with a Publisher

Thank you for typesetting our manuscript. Our comments follow. In case of doubt, please refer to the authors' PDF. We would be grateful if you could send us a new version of the typeset manuscript once you have performed the changes we indicate, so that we can check that they are correct and complete.

Line 31, near the end of the line: There is an "f" with an "n" as exponent. The exponent "n" is too close to the "f", so much so that it is hardly readable. Please increase the space between the "f" and the "n" a little so that the two letters are apart.

Lines 183 and 184: Please insert spaces
- between "Pi alpha." and "(alpha -> bool) -> bool"
- between "Pi alpha." and "alpha -> alpha -> bool"
- between "Pi alpha." and "(alpha -> bool) -> alpha".

Line 185: Please add horizontal space between the three columns.

⋮

Lines 1823 and 1827: Please remove the two DOI hyperlinks, for consistency with the other entries.