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Master's Thesis

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31. December 2099

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Master's Thesis, M.Sc. Computer Science
Eberhard Karls Universität Tübingen
Thesis period: 31. June 2099 - 31. December 2099

Abstract

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Zusammenfassung

Bei einer englischen Masterarbeit muss zusätzlich eine deutsche Zusammenfassung verfasst werden. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Contents

I Usage

This chapter provides examples of commonly used LaTeX features, including figures, tables, code listings, TikZ graphics, and mathematical equations. These examples serve as a reference for integrating similar features into your thesis. *Be sure to delete this chapter before handing in your thesis.*

1.1 Figures

Figures are an essential part of any thesis to present visual data or diagrams. Below is an example of including a figure:

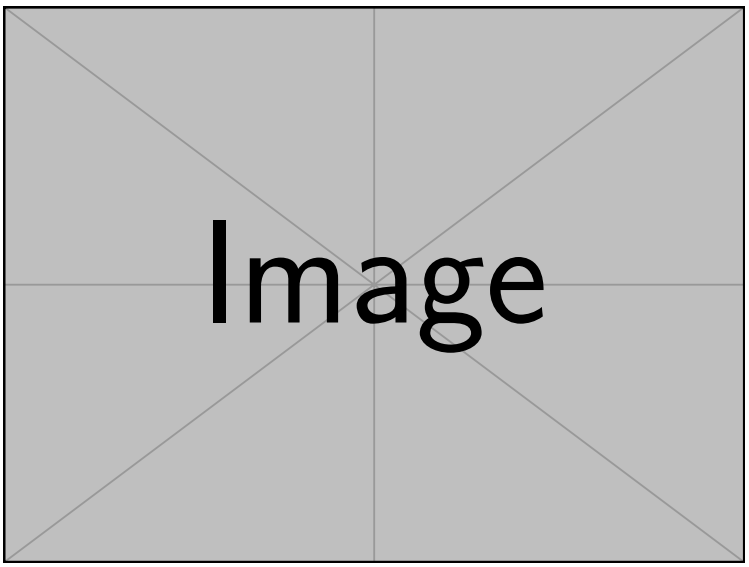
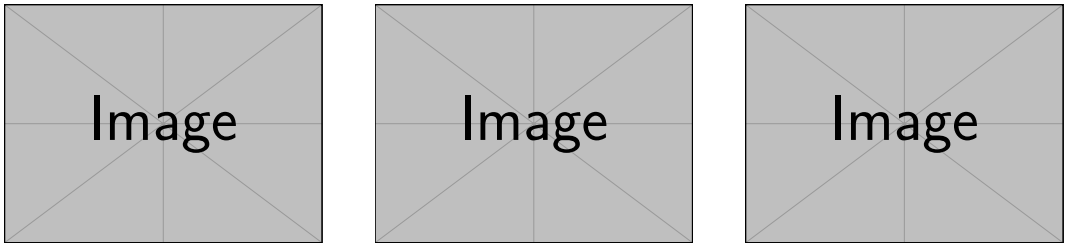


Figure 1.1: An example image.

Refer to figures in your text using `\cref`, e.g., fig. 1.1.
You can also have multiple subfigures in one `figure`.

1.2 Tables

Tables are used to organize and present data. Here is an example:
Refer to tables in your text using `\cref`, e.g., table 1.1.



(a) First subfigure. (b) Second subfigure. (c) Third subfigure.

Figure 1.2: Subreferences in LaTeX.

Column 1	Column 2	Column 3
Data 1	Data 2	Data 3
Data 4	Data 5	Data 6

Table 1.1: An example table.

1.3 Code Listings

Code listings can be included using the `listings` package. Below is an example:

Listing 1.1: An example Haskell code listing.

```
sievePrime :: Int → [Int]
sievePrime n =
    [ x | x ← [2..n],
          and [x `mod` y /= 0 | y ← [2..floor(sqrt(fromIntegral x))]]
    ]
```

Refer to the listing using `\cref`, e.g., listing 1.1.

1.4 TikZ Graphics

TikZ allows the creation of high-quality vector graphics directly in LaTeX. Here is an example of a simple diagram:

Refer to diagrams in your text using `\cref`, e.g., fig. 1.3.

1.5 Math Equations

Mathematical equations are formatted using the `amsmath` package. Below are examples of inline and display equations:

Inline equation: $E = mc^2$.

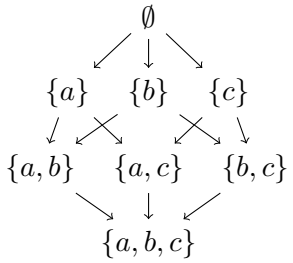


Figure 1.3: A simple TikZ diagram.

Display equation with numbers:

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0} \quad \text{(Gauss's Law)} \tag{1.1}$$

Refer to equations using `\cref`, e.g., eq. (1.1).

1.6 Natural-deduction style judgements

The `mathpartir` package is useful for typesetting natural-deduction style judgements for typing rules or other inductively defined relations. Below is an example:

$$\frac{x : \tau \in \Gamma}{\Gamma \vdash x : \tau}\ \textsc{Var} \qquad \frac{\Gamma, x : \tau_1 \vdash e : \tau_2}{\Gamma \vdash \lambda x : \tau_1 . e : \tau_1 \to \tau_2}\ \textsc{Abs}$$

$$\frac{\Gamma \vdash e_1 : \tau_1 \to \tau_2 \qquad \Gamma \vdash e_2 : \tau_1}{\Gamma \vdash e_1\ e_2 : \tau_2}\ \textsc{App}$$

1.7 Citing

For citing other work, use the `textcite` command for textual citations, like "Brachthäuser et al. (2022) said ..." or use `parencite` for non-textual citations, like "... (Brachthäuser et al. 2022)". Also check out the cheatsheet for other commands and settings. Be sure to discuss the citation style with your thesis adivsor. If in doubt, "author-year"/"author-date" styles are to be prefered over numerical citation styles.

1.8 Theorems

Use `\begin{theorem}[Title]` ... `\end{theorem}` for typesetting theorem(-like) text. `theorem` can also be exchanged for `corollary`, `lemma`, `definition`, `example`, `proposition`, `conjecture` and `remark`.

Theorem 1.1 (My Theorem)**.** My theorem proposition.

Proof. My proof. □

1.9 Todos

example

You can use `\todo` for creating todo notes in your thesis. For further usage information, check the documentation.

2 Introduction

In the introduction, you give context for your research, introduce your research question, and outline your work as well as motivate it. It is also common to add a list of contributions, i.e., bullet points on what you contribute to the research area.

3 Overview

Introduces the terminology, definitions and concepts you use in the rest of your paper here. You should mention every non-trivial piece of information here. I can be difficult to decide what to consider as trivial and non-trivial. Including too much trivial information may be seen as boring and condescending by the readers. Yet, including too little non-trivial information might be considered as a lack of understanding your research topic and area. Thus, as a rule of thumb, regard the reader as well-versed in your research area such that the basics of your field (i.e. concepts you learned in compulsory lectures) do not need to be reiterated. Everything beyond that can be seen as non-trivial.

4 Idea

In this chapter, you present your idea for answering your research question. Keep in mind that your idea does not need to be ground-breaking and exceptionally novel. Instead, this thesis should serve as proof that you can independently gather an understanding of your research area, identify a sensible research questions and scientifically answer this question.

Your idea for solving your research question can come in many form depending on which research area you delve in. It may be an algorithm, a type system, a study, a combination or something else entirely. By talking to your advisor and getting to know your research topic by reading papers, you will most certainly gather an understanding of how to tackle your research questions.

Briefly describing your idea for answering the research questions can be difficult. Be sure not to get lost in implementation details here, but rather just convey the overall idea. For example, it is of no interest here what programming language you use. Also, do not mix the discussion and evaluation with describing your idea. Try not to justify your idea here, but instead confidently describe it. There will be plenty of space for discussion in later chapters.

5 Evaluation

After presenting your idea, you now have to devise a way of convincing the reader why your idea is great. You can do this by proofing the correctness of your algorithm, proving the soundness of your type system, a proof-of-concept compiler or a benchmark of your implementation compared against pre-existing solutions. This of course depends on your research field and your approach for answering your research question. When conducting experiments and studies, be sure to explain your methodology and hypotheses before showing the results.

6 Discussion

The discussion critically evaluates your idea and evaluation. Try to think like an adversary and come up with scenarios that might break your approach. It might seem counterproductive to criticise your own work. However, every flaw you find, your reviewer might find as well. Thus, this chapter allows you to directly address these concerns and, in the best case, dispel any doubts. But of course, every work has limitations and edge cases. Acknowledging these weaknesses and arguing why they do not matter or how they might be solved by extending your work will be a testament to your scientific abilities.

7 Related Work

In this chapter, you present and discuss other work in your research area. The goal is to compare and relate your idea and results to other research. Of course, the goal is not to discredit other papers to elevate your own, but rather showcase similarities and differences. For example, presenting related work that came to similar results may be seen as evidence for the credibility of your own results. Outlining differences and improvements compared to previously presented solutions can help to further elevate your work.

Sometimes this section is also incorporated into the overview, but it can be tedious for the reader to work through related work before actually having seen your idea. Putting this chapter at the end has the added advantage that the reader is already familiar with your work and can more easily follow along when comparing it to other work.

8 Conclusion

Conclude your thesis by revisiting the most important parts of your thesis and giving a short summary of the most important results. You may also provide an outlook on future work for extending ideas.

Bibliography

Brachthäuser, Jonathan Immanuel et al. (Apr. 2022). "Effects, capabilities, and boxes: from scope-based reasoning to type-based reasoning and back". In: *Proc. ACM Program. Lang.* 6.OOPSLA1. DOI: 10.1145/3527320. URL: https://doi.org/10.1145/3527320.

Selbständigkeitserklärung

Hiermit erkläre ich, dass ich diese schriftliche Abschlussarbeit selbständig verfasst habe, keine anderen als die angegebenen Hilfsmittel und Quellen benutzt habe und alle wörtlich oder singemäß aus anderen Werken übernommenen Aussagen als solche gekennzeichnet habe.

Ort, Datum

Unterschrift