



Bern University  
of Applied Sciences



# Bachelor's Thesis

## Thesis subject

Course of study	Bachelor of Science in Computer Science
Author	Anton Muster and Cindy Example
Advisor	Prof. Dr. Super Smart
Co-advisor	PhD A. Smart
Project partner	proj partner
Expert	Some expert

Version 1.0 of November 12, 2023

- Technik und Informatik
- Mikro- und Medizintechnik



# Abstract

One-paragraph summary of the entire study – typically no more than 250 words in length (and in many cases it is well shorter than that), the Abstract provides an overview of the study.



# Contents

Abstract	iii
1. First Thesis Chapter	1
1.1. Introduction . . . . .	1
1.2. Methods . . . . .	1
1.3. Results . . . . .	1
2. Second Thesis Chapter	3
2.1. Some $\text{\LaTeX}$ Examples . . . . .	3
2.1.1. Tabular . . . . .	3
2.1.2. Math . . . . .	6
2.1.3. Include pictures . . . . .	7
2.1.4. Code Example . . . . .	7
2.1.5. Draw boxes . . . . .	8
2.1.6. Some Item-list . . . . .	10
2.1.7. Multi column environment . . . . .	10
2.1.8. Use Figures . . . . .	12
2.2. Example Text With Indices . . . . .	13
2.3. Example Text With Glossary . . . . .	13
2.4. Example Text With Citations . . . . .	13
2.5. Discussion . . . . .	14
Bibliography	17
List of Figures	19
List of Tables	21
Listings	23
Glossary	25
A. First Appendix Chapter	29



# 1. First Thesis Chapter

## 1.1. Introduction

What is the topic and why is it worth studying? – the first major section of text in the paper, the Introduction commonly describes the topic under investigation, summarizes or discusses relevant prior research (for related details, please see the Writing Literature Reviews section of this website), identifies unresolved issues that the current research will address, and provides an overview of the research that is to be described in greater detail in the sections to follow.

## 1.2. Methods

What did you do? – a section which details how the research was performed. It typically features a description of the participants/subjects that were involved, the study design, the materials that were used, and the study procedure. If there were multiple experiments, then each experiment may require a separate Methods section. A rule of thumb is that the Methods section should be sufficiently detailed for another researcher to duplicate your research.

## 1.3. Results

What did you find? – a section which describes the data that was collected and the results of any statistical tests that were performed. It may also be prefaced by a description of the analysis procedure that was used. If there were multiple experiments, then each experiment may require a separate Results section.





## 2. Second Thesis Chapter

### 2.1. Some $\text{\LaTeX}$ Examples

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

#### 2.1.1. Tabular

Measure	Data	Unit
1	2	3
4	5	6

Stadtteil	Anzahl Personen	Ausländische Bevölkerung
Innere Stadt	3748	17.9 %
Länggasse-Felsenau	17 976	17.1 %
Mattenhof-Weissenbühl	26 895	22.4 %
Kirchenfeld-Schlosshalde	23 384	13.4 %
Breitenrain-Lorraine	24 082	19.4 %

Table 2.1.: Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)

**More about Tables** Further information about tables : <https://www.latex-tutorial.com/tutorials/tables/>

**Long Tables** Further information about long tables : <https://www.overleaf.com/learn/latex/tables>

Stadtteil	Anzahl Personen	Ausländische Bevölkerung
Innere Stadt	3748	17.9 %
Länggasse-Felsenau	17 976	17.1 %
Mattenhof-Weissenbühl	26 895	22.4 %
Kirchenfeld-Schlosshalde	23 384	13.4 %
Breitenrain-Lorraine	24 082	19.4 %

Table 2.2.: Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)

Stadtteil	Anzahl Personen	Ausländische Bevölkerung
Innere Stadt	3748	17.9 %
Länggasse-Felsenau	17 976	17.1 %
Mattenhof-Weissenbühl	26 895	22.4 %
Kirchenfeld-Schlosshalde	23 384	13.4 %
Breitenrain-Lorraine	24 082	19.4 %

Table 2.3.: Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)

Table 2.4.: A sample long table

First column	Second column	Third column
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778

Continued on next page...



Table 2.4: ... continued from previous page

First column	Second column	Third column
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778

### 2.1.2. Math

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{pmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -\frac{b_f}{J} & \frac{K_m}{J} \\ 0 & -\frac{K_g}{L} & \frac{R}{L} \end{bmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} + \begin{bmatrix} 0 & 0 \\ -\frac{1}{J} & 0 \\ 0 & \frac{1}{L} \end{bmatrix} \begin{pmatrix} t_L \\ v_a \end{pmatrix} \quad (2.1)$$

### 2.1.3. Include pictures



Figure 2.1.: Some meaningful caption



Figure 2.2.: PLACEHOLDER



Figure 2.3.: PLACEHOLDER

### 2.1.4. Code Example

```
1 #include <stdio.h>
2 #include <stdlib.h>
3
4 int main( /* int argc, char **argv */ )
5 {
6     printf("Hello World!\n");
7     return EXIT_SUCCESS;
8 }
```

Listing 2.1: My very first C program.

I developed this very nice application writing "Hello World" to my terminal. The implementation is shown in listing 2.1.

#### 2.1.5. Draw boxes

Purple

Note

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Blue

Note

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Red

Note

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text,

you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.



An alert box.



A warning box.



A note box.



A recycle box.

No color set

Some BFH box without color option set. Using default.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

### 2.1.6. Some Item-list

Sometimes you explain this and that using a bullet points. This can be done in  $\text{\LaTeX}$  using an item list in a item environment.

- ▶ My first item
- ▶ The second
- ▶ ...
- ▶ ...

It is also possible to nest such environment and/or enumerate.

- ▶ My first item
  1. My first enumerated item
  2. The second
  3. ...
- ▶ The second
  1. An other enumerated item
  2. ...
  3. ...

### 2.1.7. Multi column environment

Split a part of a document in multiple columns is not so easy with WYSIWYG tools. Whit multicols  $\text{\LaTeX}$  package ... well you may know.

- |                 |                 |                 |
|-----------------|-----------------|-----------------|
| ▶ My first item | ▶ My first item | ▶ My first item |
| ▶ The second    | ▶ The second    | ▶ The second    |
| ▶ ...           | ▶ ...           | ▶ ...           |
| ▶ ...           | ▶ ...           | ▶ ...           |

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.



Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text

like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between

this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all let-

ters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text

like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- ▶ My first item
- ▶ The second
- ▶ ...
- ▶ ...

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some non-

sense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- ▶ My first item
- ▶ The second
- ▶ ...
- ▶ ...

### 2.1.8. Use Figures

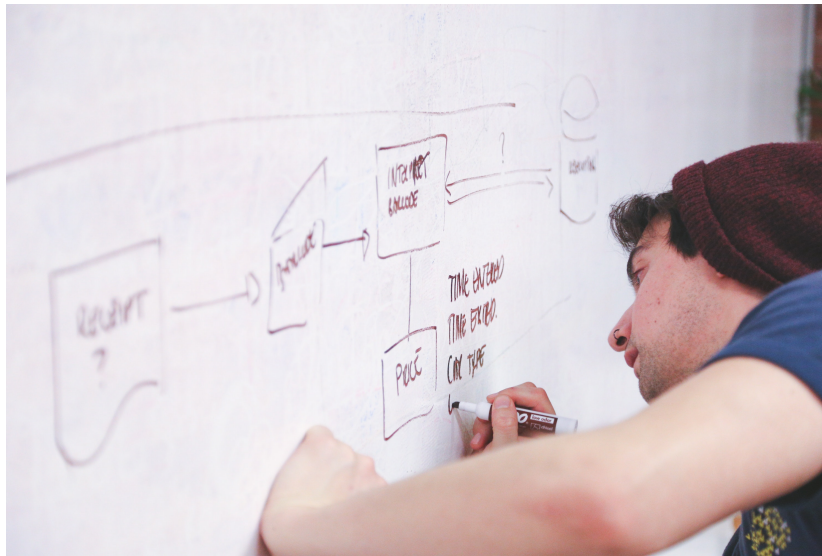


Figure 2.4.: An example of including a PDF figure.

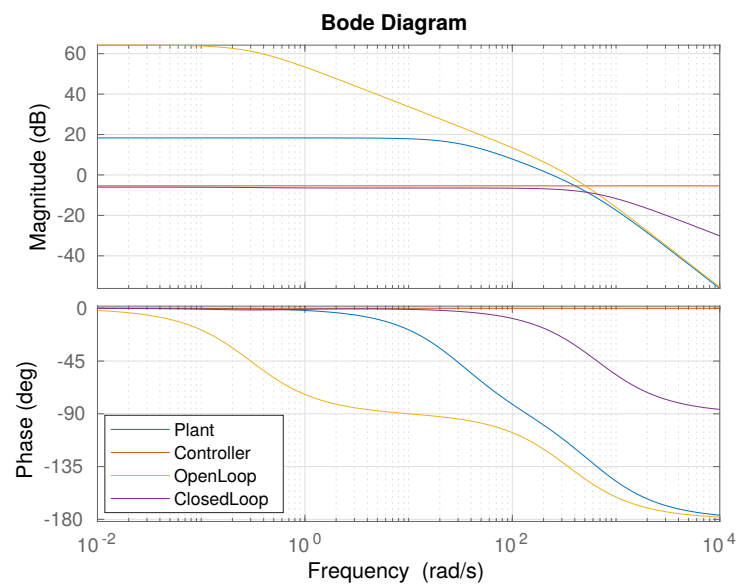


Figure 2.5.: An example of including a PDF figure.

### Use Subfigures

These subfigures requires the package `subcaption`.

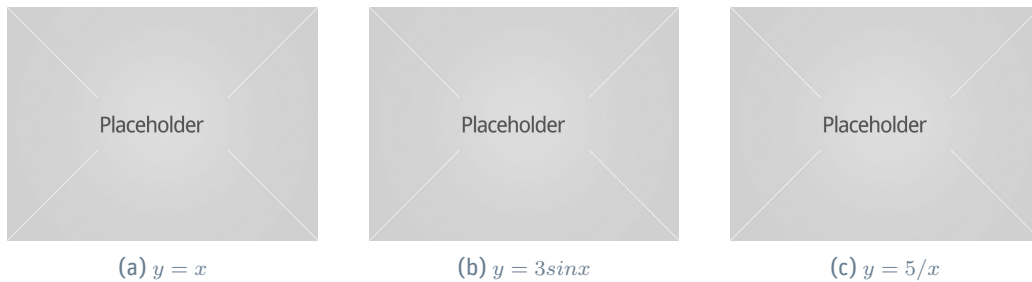


Figure 2.6.: Three simple graphs

## 2.2. Example Text With Indices

In this example, several keywords will be used which are important and deserve to appear in the Index.

Terms like generate and some will also show up.

## 2.3. Example Text With Glossary

This Zynq introduction summary has been written for bachelor students due to the introduction workshop in the “Embedded Systems” course at Bern University of Applied Sciences. The topic SoC is introduced by using Xilinx’ AP SoC platform Zynq. The subsequent summery is a brief introduction only. It is based on several tutorials in the field of SoC such as the Zynq Book or Xilinx’ AP SoC manual. We think the script provides a good introduction and helps getting the overall picture of the SoC basics. In addition we reference to our wiki tutorials that provide lots of information on how to get started with the ZedBoard.

Hey folks let’s do an ASIC design and develop some awesome RTOS! Yea ARM is nice but we can do better, can we?

## 2.4. Example Text With Citations

This document is an example of BibTeX using in bibliography management. Three items are cited: The  $\text{\LaTeX}$  Companion book [1], the Einstein journal paper [2], and the Donald Knuth’s website [3]. The  $\text{\LaTeX}$  related items are [1, 3].

## 2.5. Discussion

What is the significance of your results? – the final major section of text in the paper. The Discussion commonly features a summary of the results that were obtained in the study, describes how those results address the topic under investigation and/or the issues that the research was designed to address, and may expand upon the implications of those findings. Limitations and directions for future research are also commonly addressed.

## Declaration of Authorship

I hereby declare that I have written this thesis independently and have not used any sources or aids other than those acknowledged.

All statements taken from other writings, either literally or in essence, have been marked as such.

I hereby agree that the present work may be reviewed in electronic form using appropriate software.

November 12, 2023



A. Muster



C. Example



## Bibliography

- [1] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The  $\text{\LaTeX}$  Companion*. Addison-Wesley, Reading, Massachusetts, 1993.
- [2] Albert Einstein. Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]. *Annalen der Physik*, 322(10):891–921, 1905.
- [3] Donald Knuth. Knuth: Computers and typesetting.





# List of Figures

- 2.1. Some meaningful caption . . . . . 7
- 2.2. PLACEHOLDER . . . . . 7
- 2.3. PLACEHOLDER . . . . . 7
- 2.4. An example of including a PDF figure. . . . . 12
- 2.5. An example of including a PDF figure. . . . . 12
- 2.6. Three simple graphs . . . . . 13



# List of Tables

2.1. Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)	3
2.2. Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)	4
2.3. Anzahl Personen, ausländischer Bevölkerungsanteil und Arbeitslosenquote pro Stadtteil Ende 2005 (Statistikdienste der Stadt Bern, 2006)	4
2.4. A sample long table . . . . .	4



## Listings

2.1. My very first C program. . . . .	7
---------------------------------------	---



## Glossary

- AP SoC All Programmable System-on-Chip (AP SoC)** was introduced by Xilinx. It represents a IC which comprise a hard-core processor core surrounded by an FPGA fabric. This type of ICs are highly configurable and provide algorithm partitioning capabilities. This provides high benefit for highly scale-able applications as well as fast time-to-market
- ARM ARM** A family of processor architectures. The hard processor type which forms the basis of the Zynq processing system is an ARM Cortex-A9 version. The term ‘ARM’ may also be used to refer to the developer of the processor, i.e. a company of the same name
- ASIC Application-Specific Integrated Circuit (ASIC)** An integrated circuit which is designed for a specific use, rather than general-purpose use
- BibTeX** Program for the creation of bibliographical references and directories in  $\text{\LaTeX}$  or  $\text{\TeX}$  documents
- RTOS Real-Time Operating System (RTOS)** A category of operating systems defined by their ability to respond quickly and predictably for a given task
- SoC System-on-Chip (SoC)** A single chip that holds all of the necessary hardware and electronic circuitry for a complete system. SoC includes on-chip memory (RAM and ROM), the microprocessor, peripheral interfaces, I/O logic control, data converters, and other components that comprise a complete computer system
- ZedBoard ZedBoard** A low cost development board featuring a Zynq-7000 SoC, and a number of peripherals
- Zynq Zynq** Xilinx’ AP SoC. The characteristic feature of Zynq is that it combines a dual-core ARM Cortex-A9 processor with traditional Series-7 FPGA logic fabric
- Zynq Book Zynq Book** A book that summarizes all the important aspects when working with Zynq and provides a strong and easy understandable introduction to the topic. The book has been written by a team of University of Strathclyde Glasgow in cooperation with Xilinx





# Index

generate, 13

Index, 13

keywords, 13

others, 13



## A. First Appendix Chapter