UNIVERSITY OF COLOGNE

MASTER THESIS IN ECONOMICS

Your great thesis title

Your Name

supervisor: second reader:

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Submitted for Examination in the Study Programme *Economics (M.Sc.)*
at the *Faculty of Management, Economics and Social Sciences*

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1. Introduction

Here goes your introduction. This document can be used as a template (in this case you want to delete all my text from here to the `\bibliographystyle{chicago}` comand) but I will also give some examples of how to cite and reference, and how to use mathematics in LaTeX. Ideally, you should look at the .pdf and the .tex file at the same time to see what the code generates.

1.1. Literature Review

The literature review goes here. Let me give some examples how to cite in LaTeX using BibTeX: I cite Stigler (1980) and Jann and Schottmüller (2020) as examples (in the source file this reads `\cite{stigler1980introduction}` where `stigler1980introduction` is the label of this reference used in the .bib file.). A page in a book is cited as Solove (2010, p. 34). Note that all the cited articles, books etc. have to have an entry in the .bib file where you define the label used for citing and store all the information necessary for creating the reference list at the end of the document. You can usually copy and paste the entries for the .bib file from Google Scholar or JSTOR (and otherwise you do it by hand following Martin Osborne's guide). However, have a look at what you are copying and pasting as these automatic online references are sometimes incomplete.

The advantage of BibTeX is twofold: First, you spell the author names and the publication years correctly. Second, the reference list is automatically generated and formatted nicely.

Let me also comment on some common problems. First, how to cite a website? I suggest to cite websites as in Wikimedia Foundation (2003) and articles on news websites or blogs as in Ernst (2020). Second, capitalization in the reference list: The here chosen bibstyle will put all but the first letter of the title (of a journal article) in lower case. This should be avoided for names etc. To do so put capital letters in between curly brackets in the .bib file, e.g. "On {N}ash equilibrium" instead of "On Nash equilbirium". You can see an example for this in the BibTeX entry Ernst (2020).

2. Mathematics

Mathematics within a line of text is put between $ marks. For example, `$\frac{3}{4}$` yields the fraction $\frac{3}{4}$ or $\lim_{x\to\infty} e^{-x} = 0$ is generated by `$\lim_{x\rightarrow \infty}e^{-x}=0$`. Subindeces as in x_1 are written as `$x_1$`. Here is how you use math environments:

Definition 1 (Fixed Point)**.** *Let $f : D \to R$ where $D, R \subseteq \mathbb{R}$. If $f(x) = x$, then x is called a* fixed point *of f.*

You reference the definition as "definition 1" (that is `definition \ref{def:fp}` in the source file where `def:fp` is the label of the definition above). Similarly, you can reference

sections as `section \ref{sec:intro}` which yields "section 1". Also subsection 1.1 can be referenced using `subsection \ref{sec:literature}`. The advantage of such references over writing "section 1.1" directly is that your references will automatically adjust if you change something in the structure of your document; for example, if you insert another section. (Note that you have to compile LaTeX twice before it gets a new reference properly formatted.)

Note that you can generate numbered equations that can be similarly referenced as follows:

$$f(x) = x. \tag{1}$$

This equation can be referenced as equation (1), i.e. (`\ref{eq:fixedPoint}`) in the source file where `eq:fixedPoint` is the label of the equation above.

To get several equations in a row with aligned equality signs you can use the align environment where `&` indicates the position that should be aligned and `\\` indicates a linebreak, i.e. the start of the next equation:

$$f(x) = x \tag{2}$$
$$g(x) = x^2 + x + 5 \tag{3}$$

Each equation can be referenced on its own like equation (2) or equation (3) here.

3. Results

A mathematical result, like a proposition, is written in a similar environment as a definition.

Proposition 1. *Let $f : [0, 1] \to [0, 1]$ be an increasing function. Then, f has a fixed point.*

4. Font face and miscellaneous formatting

If you want to *emphasize* a certain word or part of a sentence, you do so using the command `\emph{whatever you want to emphasize}`. You can also use **bold fonts** using the command `\textbf{whatever should be in bold}`.

Another useful hint concerns paragraph formatting. If you want to start a new paragraph, you either have to leave a blank line in your code (hit Enter twice) or you use the command `\par`. A normal linebreak occurs if you use `\\` but please do not use this to start a new paragraph as it does not indent the first line of the next paragraph which is considered bad style. (I do it here nevertheless, so you see the difference.)
At some point you may want to use an enumeration. LaTeXprovides the enumerate environment for this:

1. first item

2. second item

3. third item.

   You can even have subenumerations inside an enumeration:

1. first item

2. second item with following subitems

   (a) subitem one

   (b) subitem two

3. third item

   For lists that are not numbered, there is the itemize envrionment:

- first item

- second item

- third item.

5. Figures and Tables

You can include a graphic with the command `\includegraphics{filename}` (recommended file formats are png, eps or pdf). Usually, it is a good idea to place the graphic in a figure environment as here:
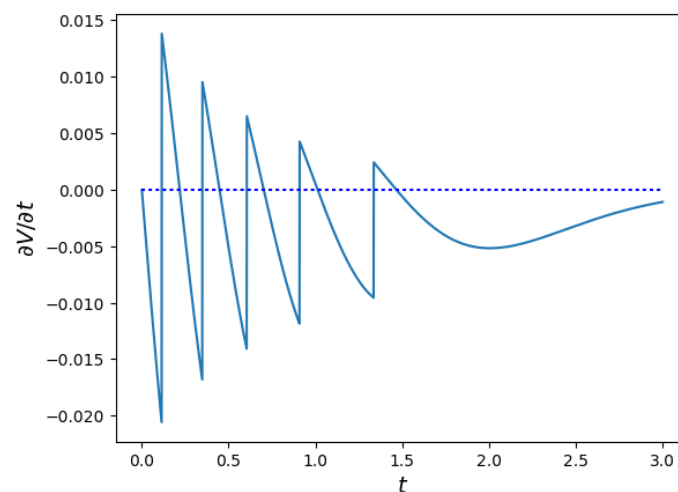

Figure 1: A nice figure

We can reference the figure as figure 1 using its label.

Sometimes you need to have a nicely formatted table. I give a simple example; see `https://en.wikibooks.org/wiki/LaTeX/Tables` for more on this. In case you want to present a regression output in a table, please note that there are packages producing LaTeXtables for the most common statistics programmes.

Country	Capital	Population	Source
China	Beijing	1,404,556,640	National population clock
Japan	Tokio	125,930,000	Monthly provisional estimate
Germany	Berlin	83,157,201	National quarterly estimate

Table 1: Countries and their population

Country	Capital	Population	Source
China	Beijing	1,404,556,640	National population clock
Japan	Tokio	125,930,000	Monthly provisional estimate
Germany	Berlin	83,157,201	National quarterly estimate

Table 2: Countries and their population a bit simpler

6. Conclusion

All scientific writing should be done in LaTeX.

Appendix

A. Proofs

Proof of proposition 1: Let

$$A = \{x : \ x \le f(x)\}. \tag{4}$$

As f maps into $[0,1]$, $0 \le f(0) \in [0,1]$ and therefore $0 \in A$ and $A \ne \emptyset$. Let $x^* = \sup A$.

$f(x^*) \le x^*$: suppose not, i.e. suppose $f(x^*) > x^*$, let $\varepsilon = f(x^*) - x^* > 0$ and observe that $x^* + \varepsilon < f(x^*) \le f(x^* + \varepsilon)$ because f is increasing. Hence, $x^* + \varepsilon \in A$ which contradicts the definition of x^*.

$f(x^*) \ge x^*$: if $x^* \in A$, this holds by the the definition of A, see equation (4). But $x^* \in A$ has to hold by the definition of x^* as otherwise f would have to discontinously drop downward at x^* contradicting that f is increasing.

Hence, $x^* = f(x^*)$. $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\square$

B. Second Appendix

Another section in the appendix.

References

Ernst, A. (2020). Was haben Sanktionen gegen Lukaschenko mit der Türkei zu tun? Nichts, doch Zypern blockiert mit der Verknüpfung die EU-Aussenpolitik. `https://www.nzz.ch/international/eu-sanktionen-gegen-weissrussland-zypern-blockiert-ld.1577839`. Accessed: 2020-10-01.

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