A template for master thesis at DEIB

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Here you can put your dedication, like:

To time, that do not go backwards

— A & D & E

ACKNOWLEDGMENTS

Here you can put acknowledgements to people that helped you during the thesis. Remember that helping students to write thesis is part of the job of some of them, and they're also paid for that. Please make sure to thank them for what they weren't supposed to do.

Remember also that this page is part of your thesis. I know that your boyfriend/girlfriend is very important to you and you cannot live without her/him, as it is for me. But there's no need to put her/his name here unless she/he gave a proper contribution to this work. Same goes for friends, parents, drinking buddies and so on.

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[June 11, 2015 at 17:00 – classicthesis version 1.0]

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LISTINGS

ACRONYMS

EMODPS Evolutionary Multi-Objective Direct Policy Search

OS operating system

XML eXtensible Markup Language

[June 11, 2015 at 17:00 – classicthesis version 1.0]

ABSTRACT

An abstract is a brief of a research article, thesis, review, conference proceeding or any in-depth analysis of a particular subject or discipline, and is often used to help the reader quickly ascertain the paper's purpose. When used, an abstract always appears at the beginning of a manuscript or typescript, acting as the point-of-entry for any given academic paper or patent application. Abstracting and indexing services for various academic disciplines are aimed at compiling a body of literature for that particular subject.

Max 2200 characters, spaces included.

SOMMARIO

Per abstract si intende il sommario di un documento, senza l'aggiunta di interpretazioni e valutazioni. L'abstract si limita a riassumere, in un determinato numero di parole, gli aspetti fondamentali del documento esaminato. Solitamente ha forma "indicativo-schematica"; presenta cioé notizie sulla struttura del testo e sul percorso elaborativo dell'autore.

Max 2200 caratteri compresi gli spazi.

[June 11, 2015 at 17:00 – classicthesis version 1.0]

ESTRATTO

"...il testo delle tesi redatte in lingua straniera dovrà essere introdotto da un ampio estratto in lingua italiana, che andrà collocato dopo l'abstract."

PREFACE

A preface is an introduction to a book or other literary work written by the work's author. A preface generally covers the story of how the book came into being, or how the idea for the book was developed.

MOTIVATION

Graduating is not the motivation that one expects here.

AN INTRODUCTION TO THE WRITING OF SCIENTIFIC TEXTS

Science, my boy, is made up of mistakes, but they are mistakes which it is useful to make, because they lead little by little to the truth.

— Verne *Journey to the Center of the Earth*

1.1 GENERAL RULES

A scientific manuscript should be short, complete, clear, and logical. It should convey the messages in the easiest, but still correct way. Before writing, it may be useful to identify who the text is addressed to or the potential readers. The type of readers should then lead the writing style. For example, the following type of text are all different, both for what concern the contents and the way the manuscript is organized:

A BOOK it is usually written for students;

A SCIENTIFIC PAPER it is written for peers: from scientists to scientists;

A USER MANUAL it is written for learning how to use a software, for example.

When writing the thesis, keep in mind that the reader is probably a person who knows about the specific research field, but does not know what you did, so do not take things for granted.

It may be useful to develop the text in different stages. First, define the structure of the text (see also Section 1.2). Second, make a list of the main points in each section. Then, further develop the list by sketching a couple of sentences for each point. Finally, write the entire text. This may be helpful to focus on the main contents of the text, the messages you would like to convey, and, not less importantly, to share and discuss the organization of the manuscript with your supervisor.

In general, each paragraph should convey one message. Try to keep the sentences short, because this will ease the reading and understanding process. Avoid using phrases that are just a repetition, do not add any new message, or do not further contribute to understanding. Avoid using synonyms: in scientific writing they may confuse the readers. For example:

> We use a modeling framework composed of an optimization step followed by a simulation step. The modeling

~~procedure~~ allows to analyze the system evolution.
We use a modeling framework composed of an optimization step followed by a simulation step. The modeling framework allows to analyze the system evolution.

Use the active form if you are referring to what you did. For example:

~~The HBV model is chosen because it is a parsimonious model.~~
We chose the HBV model because it is a parsimonious model.

The passive form, instead, is preferred to indicate what is done in the literature. For example: "The HBV model is used because it is a parsimonious model."

Be careful in using pronouns such as "it" or "they" to refer to a concept in the previous sentence. It is fine, if the previous sentence convey just one concept, otherwise the pronoun may be confusing. In these cases, it is better to repeat the concept in the second sentence. For example:

We assigned the same parameters to the different land use classes in the catchment. ~~They~~ are taken from Wilson et al. (2014).
We assigned the same parameters to the different land use classes in the catchment. The land use classes are taken from Wilson et al. (2014).

Bullet lists are welcome. The items should be ranked following a rationale, for example they can be ranked by importance, preference, priority, etc.

1.2   THE STRUCTURE OF A SCIENTIFIC TEXT

The typical structure is described in the following. Nevertheless each thesis may have a different structure which can be customized to better highlight the work done. Before writing the entire thesis, you should identify a temptative structure and discuss it with your supervisor (see Section 1.1).

INTRODUCTION The Introduction should introduce the reader to the argument developed in the thesis. It should set the context and the reason why the topic is interesting. State the research questions addressed in the thesis and the objectives of the work. The novelties of the work should also be highlighted. You can also briefly mention the methods used.

LITERATURE REVIEW It contains the description of previous works and what has been already done in the literature. The text should be complemented with appropriate references (see Section 1.3).

MATERIALS AND METHODS It should describe the methods and techniques employed to address the research questions, the workflows, the hypothesis, the experimental setting, etc. If you are using a specific dataset, you should introduce it in this section. In principle, any reader should be able to reproduce the work and experiments you did by reading this section.

CASE STUDY If you are focusing on one or more case studies, this section should include the description of the study sites. Do not describe anything about the study site, but only include information that are relevant for your work, to understand what follows or why the application is relevant.

RESULTS This section should describe the results of the analysis. The text should be complemented with figures and tables, which are intended to support the evidences described in the text and to better comunicate the results (see Section 1.5).

DISCUSSION This section contains the interpretations of the results and state the conclusions you can draw from the analysis. You should also discuss the limitations of your approach and identify future research paths. This section may be merged with the "Results" section.

CONCLUSION You should make a short summary of the objectives of the work, the main results, and what you can conclude from your analysis. If you listed one or more research questions, you may want to formulate the reply which should be based, of course, on the evidences produced by your work. You can also briefly mention limitations and future works.

1.3 IN-TEXT CITATIONS

Citations usually goes just after the sentence you are quoting or paraphasing using brackets. The most commonly used type of citation is: author, year. When the reference has two or three authors of the source, cite all of them. If there are more than three authors, you can cite the first author followed by "et al." If the authors are subject of a sentence, only the year of publication is included in the brackets. For example:

> Air passing above a forested area is more humid than the one passing over a not forested area (Spracklen et al., 2012).

> Spracklen et al. (2012) demonstrated an increase of moisture in the air that passes above a forested area than a not forested one.

Do not copy and paste form other sources unless you are directly quoting from a work. For example:

> The approach is summarized by Philbrick and Kitanidis (1997): "Together modelling and optimization are sometimes called Systems Analysis."

1.4 ACRONYMS

Acronyms are welcome, but it is better not to over-use them. A text full of acronyms is difficult to read and may confuse the readers or force them to remember what they mean or to go back to the point where they are defined. For example:

> In the US, the notion of an NWO became popular after the terrorist attacks on the WTC. However, officials in NATO and the WTO rarely refer to an NWO in proceedings relating to the GATT, and it can be said that the MVTO, the MFN clause, and SROs have little to do with an NWO.[1].

Acronyms should be always defined the first time they are used (this may not apply to very popular acronyms, e. g. , NASA, IPCC, etc., which may remain undefined). If you use the suggested LATEX environment, `acronyms`, as explained in subsection 2.4.2 you can avoid to remember which is the first time you used the acronym. It does that for you. For example:

> In this thesis we adopt Evolutionary Multi-Objective Direct Policy Search (EMODPS). EMODPS is an approximate dynamic programming method that combines direct policy search and multi-objective evolutionary algorithms.

Be consistent: once you defined an acronym, readers will expect that you use the acronym instead of the full description. It is better to summarize all the acronyms in a dedicated table. This is done automatically if you use write every acronym in the dedicated environment `acronyms`. You find the list after the table of contents. The command transform the word into a link to the list for people for forget the meaning while reading.

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1 Example taken from http://www.scribendi.com/advice/the_correct_use_of_acronyms.en.html

1.5 FIGURES AND TABLES

Figures and tables can be used to present a large amount of information to the reader and can be used to assist communication. Still, try to keep the minimum number of figures/tables. Figures and tables are not self-explanatory. Use the text to focus on the important point the reader should draw from them.

Tables/figures should be sequentially numbered as they appear in the text (in other words, Figure 2 can not be cited before Figure 1). They should appear close to the text where they are cited first. All the figures/tables included in the thesis must be cited somewhere in the text.[2]

Each figure/table should be understood without reference to the text. Captions should, then, contain a brief description of the figure's contents, for instance an explanation of the legend (see Figure 1.1).
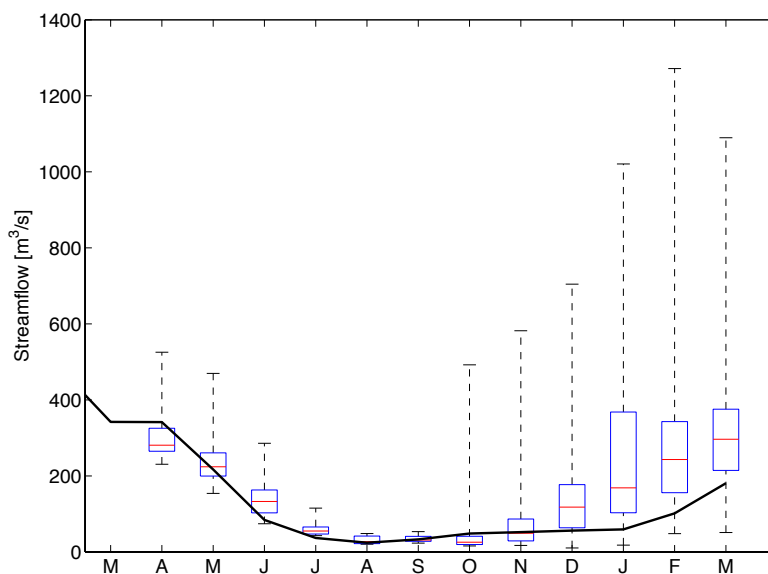

Figure 1.1: Streamflow forecast ensemble on April 1st 2000. The boxes show the 25%, 50%, and 75% percentiles, while the whiskers represent the minimum and maximum ensemble members, thus indicating the full range of uncertainty. The solid black line represents the observations.

Figures should always be good quality figures. Axis tag, labels, and legend should have an appropriate font size. Keep always the original figure (for example, `.fig` if you created the figure with matlab): this will allow you or who is working with/after you to quickly modify it or recover the original data, if needed. When applicable, keep the

2 LATEX is of great help here: for instance, you should not worry about number ordering. Specific code for figures as well as for tables is given in subsection 2.4.2.

same axis ranges to the figures: it will ease the comparison between different figures. When applicable/possible, use subfigures to ease the comparison between figures.

Finally, if you are using figures, tables and/or data from other sources, for example from other publications, cite always the reference. For example:

"[...], taken/modified from Jones et al. (1950)"

1.6   SUBMISSION TO UNIVERSITY: FOLLOW THE INSTRUCTIONS

Visit this link for the updated information about the content of the thesis.

"Alcune Scuole forniscono linee guida specifiche cui i laureandi devono attenersi per la redazione della tesi. Per ulteriori informazioni: www.tedoc.polimi.it/..."

1.6.1   *Archiving electronic documents: PDF/A*

PDF/A is an ISO-standardized version of the Portable Document Format (PDF) specialized for the digital preservation of electronic documents. PDF/A differs from PDF by prohibiting features ill-suited to long-term archiving, such as font linking (as opposed to font embedding). The ISO requirements for PDF/A file viewers include color management guidelines, support for embedded fonts, and a user interface for reading embedded annotations.

Universities usually requires this standard but they're also not aware that common programs like MS Word, OpenOffice and so on aren't really able to produce compliant PDFs. In Latex, there's some development going on but at the time of writing, the available commands are still too obscure and buggy. So in the end, forget the PDF/A for now.[3]

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3 Or DIY and then make a pull request on github :D.

2

PRACTICAL GUIDE TO "CLASSICTHESIS AT DEIB"

This template is ready to be used when writing a thesis at Dipartimento di Elettronica, Informazione e Bioingegneria. It is a modified version of Classic Thesis by André Miede that can be found here http://code.google.com/p/classicthesis/.

2.1 LEARN LATEX

LATEX is a document preparation system and document markup language. It is widely used for the communication and publication of scientific documents in many fields, including mathematics, physics, computer science, statistics, economics, and political science.

LATEX users are weird people who care about the ligature between "f" and "i" and gets pissed off every time they look at a MS Word document. Nevertheless, they can explain themselves very well as shown in some beautiful guides for the LATEX world. Our preferred one for beginners is "The Not So Short Introduction to LATEX 2_ε", which can be found here.[1] For italians we also strongly suggest "L'arte di scrivere con LATEX", that can be found here.[2] It contains everything needed, however I suggest the reading of chapter 3 for a short introduction. "ClassicThesis" is another guide of the same author that can be useful, download it here.[3]

2.2 INSTALL LATEX

If you don't have already a LATEX system installed, this section will explain everything you need. The easiest way to get LATEX is to install TeXLive, which works on all operating systems (OSs). In https://www.tug.org/texlive/ you find the instructions and the files needed - and also get in touch with minimalism of TEXusers.

Then you will need an editor: I strongly recommend TeXworks because it's very simple and available on all the platforms. Also you don't need to install it, it's already included in TeXLive. The official documentation of TeXworks is available here;[4] I strongly recommend the reading of chapter 3. Alternatevely you can read an italian manual: profs.sci.univr.it/... (just 13 pages, read it!).[5]

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1 http://www.ctan.org/pkg/lshort
2 http://www.lorenzopantieri.net/LaTeX_files/ArteLaTeX.pdf
3 http://www.lorenzopantieri.net/LaTeX_files/ClassicThesis.pdf
4 https://docs.google.com/file/d/0B5iVT8Q7W44pMk1WSFRKcDRlMU0/preview
5 If you already have a preferred editor, just keep using yours.

After opening TeXworks, I strongly suggest to set these two additional things:

- open Preferences, then go the Composition tab: in the second box there, the "Process instruments", push the plus button. In the window just opened, write `Biber` in the "Name" field, `biber` in the "Program" field (lowercase!) and then press the plus button to add the argument `$basename`;

- again in the same window, set "Hide console output" to "never".

Then just test the installation of the template:

A. go into the template home folder;

B. open the file `ClassicThesis_DEIB.tex`;

C. select `pdfLaTeX` from the dropdown menu in the top right of the TeXworks window;

D. press the rounded green button: it compiles the `.tex` file for the first time and open the resulting `.pdf`;

E. select `Biber` from the same dropdown menu and press again the green button: this compiles the bibliography, a thing you need to repeat only when you change the file `Bibliography.bib`;

F. select `pdfLaTeX` again and recompile: this is needed to build indices and crossreferences;

The above compilation procedure is the standard way to translate the LaTeX code into pdfs.

2.3 ONLINE EDITOR

If the above procedure seems too difficult to you and you have an internet connection always available, you might think to use an online editor. The best choice at the time of writing is http:\\sharelatex. com where you can even find this template after registration to the site by looking for "Classic Thesis At DEIB". Your project will be saved on their server but you can also download them. The platform allows up to two authors for free accounts.

There is no need to provide instructions for its use since the website has them. They also have an online LaTeXguide which is also very useful.

2.4 BUILDING BLOCKS

2.4.1 *File structure*

The template is organized in multiple file and folders:

A. `ClassicThesis_DEIB.tex` is the main file to be compiled, found in the root folder. You should just add the source filenames you want to include and any hyphenation you need to explictly specify.

B. `classicthesis-config.tex` contains options that can be chosen for this template, like the `draft` one that prints date and time at the bottom of every page. It contains also the definition for the title, the author and others stuff displayed in the titlepage. Comments within the file should guide you.[6] Take a look at it!

C. `Bibliography.bib` is the *Bibtex* database: it is a normal textfile where you should put books and articles read;

D. `Chapters` contains the files for the main chapters of your thesis; this is where you will add the chapters text, as well these very words in line 41 of the file `Conclusion.tex`;

E. `CodeFiles` contains any code snippet you want to include in your thesis with the environment `listings`; it might be some relevant Matlab or C code, as well as long bash scripts;

F. `FrontBackmatter` contains various files that are included in the main one to produce abstract, titlepages, acknowledgements, ... Follow the instructions below to modify them in order to suits your needs;

G. `Images` contains the `.pdf` or `.png` versions of the images of the thesis. A `sources` subfolder is also provided for keeping things well organized.

To modify abstract, preface, acknowledgements snd acronyms, you need to go into the folder `FrontBackmatter` where you will find the following:

ABSTRACT.TEX contains the text displayed as "abstract" and "sommario" just after the list of figures, tables, etc. Modify the text and leave the rest.

ACKNOWLEDGMENTS.TEX contains the text put just before the table of contents. Modify the text to suit your needs.

ACRONYMS.TEX contains the environment `acronym` with the definition of all the acronyms that will be used within the text. Add your own to the list and put the longest as parameter of the environment.

AUTOPARTS folder contains things that should work without your intervention. Forget them.

---

6 comments are the rows starting with %.

DEDICATION.TEX same usage and structure as `Acknowledgements.tex`.

ESTRATTO.TEX Politecnico di Milano requires an italian long excerpt of theses written in foreign languages.

FRONTESPIZIO.TEX and `FrontespizioIT.tex` are the cover page in english and italian, respectively. Politecnico di Milano requires the italian version of the english cover, so there it is. Both should work perfectly if you modify section 2 of the file `classicthesis-config.tex`, but you may not like the style so modify them as you prefer.

PREFACE.TEX same usage and structure as `Acknowledgements.tex`.

PUBLICATION.TEX same usage and structure as `Acknowledgements.tex`, but not included by default. Activate it by uncommenting the relevant line in `ClassicThesis_DEIB.tex`.

RETROFRONTESPIZIO.TEX contains the colophon. In most cases is fine as it already is.

2.4.2 *Special environments*

The command graffito is used to put some text here, usefull to underline important things before long paragraphs.

In addition to common LaTeX environments, this thesis is set to use:

- `\begin{aenumerate}` to produce an `\enumerate` with letters instead of numbers, as in the file list above;

- `\blockcquote[][]{}{}` to "produce a quotation with reference to author and page" [see 1, p. 111]. If the quotation is longer than two rows is indented. This is provided by the package `csquotes`, which settings are in `classicthesis-config.tex`. The package also provides `\enquote{the citation}` that produces "correct quatation style" according to the language in use.

- `\ac{}` and its variations, defined by package `acronyms`, provide nice handling for acronyms, like eXtensible Markup Language (XML), produced with the code `\ac{XML}`. List them within the environment `acronym` in the file `FrontBackmatter/Acronyms.tex`.

- the so called semi-dynamic referencing for chapter, sections, subsections, appendices, figures, tables and equations. They are a set of commands like `\myChap{label_key}` that produce things like chapter 1. There are also capital versions of the commands (`\MyChap{}` produces Chapter 1). They need a `\label{name}` anchor next to the referred thing.

    - `\myChap` for chapters;
    - `\mySec` for sections;
    - `\mySubsec` for subsections;
    - `\myAppendix` for appendices;

> – \myFig for figures;
>
> – \myTab for tables;
>
> – \myEq for equations;

- references to bibliography are produced in the usual way with \cite{bib_key} [1] and its variations \citeauthor{bib_key}, \citetitle{bib_key} and others.

- footnotes are useful to provide information which are not required to understand a sentence but provide interesting details. You can create them with \footnote{text}.[7]

- figures are handled usually with the code

  ```
  \begin{figure}
  \centering
  \includegraphics[width=\columnwidth]{Images/your_image_name.pdf}
  \caption[Short description]{Long description.}
  \label{fig:a_name}
  \end{figure}
  ```

  which produces things like figure 2.1. Take care of the short description: it appears in the list of figures and should be just a reference, not a exhaustive description. Of course, you need to put the image file your_image_name.pdf in folder Images/. We suggest to keep things organized: create a folder for each chapter and keep the original source/working file in the same place.

- tables are produced with

  ```
  \begin{table}[tb]
  \footnotesize
  \centering
  \begin{tabularx}{0.8\textwidth}{llrcl}
  \toprule
  \tableheadline{l}{Algorithm} &
  \tableheadline{l}{Parameter} &
  \tableheadlineMore{3}{c}{Suggested Values} \\
  \midrule
  \tablefirstcol{l}{Any}
  & \acs{NFE}  & $10\,000 $ & $ \div $ & $ 200\,000$ \\
  & Population Size  &  $10 $ & $ \div  $ & $ 1000$ \\
  \midrule
  ```

---

7 They should be placed after the punctuation mark and preferably at the end of the paragraph. In fact, they should not interrupt the reading flow. If you need to put a footnote in the middle of a paragraph, or of a sentence then the note should be part of the main text.
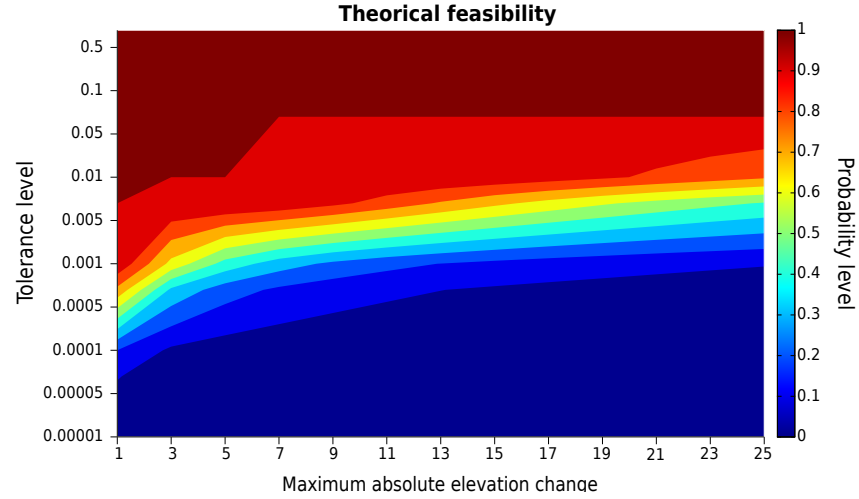
Figure 2.1: Thing taken from our master thesis whose meaning have been completely forgotten.

ALGORITHM	PARAMETER	SUGGESTED VALUES		
Any	NFE	10 000	÷	200 000
	Population Size	10	÷	1000
GDE3	DE step size	0.0	÷	1.0
	Crossover rate	0.0	÷	1.0

Table 2.1: Parameters needed for things that are not needed anymore themselves.

```
\tablefirstcol{l}{\ac{GDE3}}
& \ac{DE} step size & $0.0 $ & $\div $ & $ 1.0$ \\
& Crossover rate  & $0.0$ & $ \div $ & $ 1.0$ \\
\bottomrule
\end{tabularx}
\caption[Short description]{Long description.}
\label{tab:MOEAandParameters}
\end{table}
```

which produces table 2.1. \myfloatalign, \tableheadline{}{} and its variation \tableheadlineMore{}{}{} and \tablefirstcol{}{} are used to give a common style to all tables in the document. Use them! They are defined in `classicthesis-config.tex`.

- equation are produced in classic LATEX way and they turn out be something like this

$$\nabla \mathbf{q_s} = U(x, y) - b_t \tag{2.1}$$

2.5 CONTRIBUTING TO THIS TEMPLATE

Suggestion and improvements are welcome at https://github.com/
Lordmzn/ClassicThesis-at-DEIB or via email at emanuele.mason@
polimi.it, andrea.cominola@polimi.it or daniela.anghileri@polimi.
it.

BIBLIOGRAPHY

[1] R. Bringhurst. *The Elements of Typographic Style*. Version 3.2. Point Roberts, WA, USA: Hartley & Marks Publishers, 2008 (cit. on pp. 10, 11).

[2] D. E. Knuth. "Computer Programming as an Art." In: *Communications of the ACM* 17.12 (1974), pp. 667–673 (cit. on p. 17).

[3] J. Verne. *Journey to the Center of the Earth*. Classics illustrated. Huge Print Press, 1957. ISBN: 9780758311993 (cit. on p. 1).

A

APPENDIX EXAMPLE: CODE LISTINGS

*We have seen that computer programming is an art,
because it applies accumulated knowledge to the world,
because it requires skill and ingenuity, and especially
because it produces objects of beauty.*

— Knuth, "Computer Programming as an Art," 1974

A.1 THE `listings` PACKAGE TO INCLUDE SOURCE CODE

Source code is usually not part of the text of a thesis, but if it is an original contribution it makes sense to le the code speak by itself instead of describing it. The package `listings` provide the proper layout tools. Refer to its manual if you need to use it, an example is given in listing A.1.

Listing A.1: Code snippet with the recursive function to evaluate the pdf of the sum Z_N of N random variables equal to X.

```cpp
std::vector<int> values_of_x(number_of_values_of_x,
  min_value_of_x);
for (unsigned int i = 1; i < number_of_values_of_x; i++) {
  values_of_x[i] = values_of_x[i - 1] + 1;
}
prob_x = 1.0 / number_of_values_of_x;
std::vector<std::vector<double> > p_z;
for (unsigned int idx = 0; idx < p_z.size(); idx++) {
  p_z[idx] = std::vector<double>(
    (max_value_of_x * (idx + 1) - min_value_of_x
      * (idx + 1)) + 1, INIT_VALUE);
}

double prob(int Z, int value_of_z) {
  if (value_of_z < min_value_of_x * Z ||
    value_of_z > max_value_of_x * Z) {
      return 0.0;
  }
  if (value_of_z < min_value_of_z ||
    value_of_z > max_value_of_z) {
      return 0.0;
  }
  int idx_value_of_z = -(min_value_of_z - value_of_z);
  int idx_N = Z - 1;
  if (p_z[idx_N][idx_value_of_z] == -2.0) {
    if (Z > 1) {
      double pp = 0.0;
      for (unsigned int i = 0; i < number_of_values_of_x; i++) {
        pp += prob(Z - 1, value_of_z - values_of_x[i], p);
      }
      p_z[idx_N][idx_value_of_z] = prob_x * pp;
    } else {
      if (Z == 1) {
        for (unsigned int j = 0; j < number_of_values_of_x; j++)
          {
          if (value_of_z == values_of_x[j]) {
            p_z[idx_N][idx_value_of_z] = prob_x;
            break;
          }
        }
      }
      if (p_z[idx_N][idx_value_of_z] == INIT_VALUE) {
        p_z[idx_N][idx_value_of_z] = 0.0;
      }
    }
  }
  return p_z[idx_N][idx_value_of_z];
}
```