



المدرسة الوطنية للذكاء الاصطناعي والرقمنة - مركان  
ÉCOLE NATIONALE DE L'INTELLIGENCE ARTIFICIELLE ET DU DIGITAL - BERKANE  
ΕΠΙΧΡΕΙΑ ΕΚΠΑΙΔΕΥΣΗΣ ΕΚΤΕΛΕΣΗΣ ΕΡΕΥΝΑΣ - ΘΕΣΣΑΛΙΑ

# Rapport de stage PFA à Majal Berkane

Conception d'un véhicule maritime de surface  
sans pilote, connecté et multifonction

AbdElMalek Lamkadem

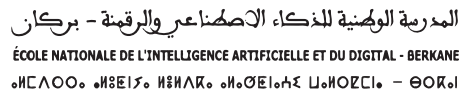
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Berkane, août 2025





Berkane, août 2025



# Remerciements

Nous tenons à exprimer notre profonde gratitude à *M. Mouhammed Berroukech*, notre encadrant, pour son accompagnement constant, ses conseils avisés et son expertise précieuse tout au long de la réalisation de ce projet. Ses orientations pertinentes et ses remarques constructives ont été déterminantes pour la réussite de notre travail.

Nous remercions également l'ensemble des membres de notre équipe — *M. Lamkadem Abdelmalek, Mme Hamdani Hajar et Mme M'Hajar Soukaina* — pour leur implication, leur esprit de collaboration et leur engagement sans faille, qui ont permis d'atteindre nos objectifs dans les meilleures conditions.

Nos sincères remerciements s'adressent aussi à l'entreprise *Majale Berkane* pour nous avoir accueillis et mis à disposition les ressources, l'encadrement technique et l'environnement professionnel nécessaires à la concrétisation de ce projet.

Enfin, nous exprimons toute notre reconnaissance à nos familles et à nos amis pour leur soutien moral, leurs encouragements constants et leur patience, qui ont été pour nous une source essentielle de motivation et de persévérance.



# Abstract

## Orientation pour l'Écriture

In the *Abstract* section, provide a concise summary of your project, highlighting the key points. Begin with a brief statement of the problem or objective, followed by a description of your approach or methodology. Summarise the main results or findings, emphasising their significance or implications. Conclude with a sentence or two on the overall contribution or impact of your work. Keep the abstract clear and focused, ideally within 150-250 words, to give readers a quick understanding of your research and its importance. **Keywords :** Keyword A, Keyword B, Keyword C.





# Résumé

## Orientation pour l'Écriture

Dans la section *Résumé*, présentez un résumé concis de votre projet en mettant en avant les points clés. Commencez par une brève déclaration du problème ou de l'objectif, suivie d'une description de votre approche ou méthodologie. Résumez les principaux résultats ou conclusions en soulignant leur importance ou leurs implications. Concluez par une ou deux phrases sur la contribution globale ou l'impact de votre travail. Le résumé doit être clair et concis (idéalement 150-250 mots) pour permettre aux lecteurs de comprendre rapidement votre travail et son importance. **Keywords :** Mot-clé A, Mot-clé B, Mot-clé C.



# Déclaration sur l'Utilisation de l'Intelligence Artificielle

## **i** Orientation pour l'Écriture

Il est une bonne pratique académique d'indiquer brièvement comment, pourquoi et quand l'IA a été utilisée. Expliquer les actions entreprises et les raisons qui les sous-tendent encourage la réflexion critique, approfondit la compréhension du rôle de l'IA dans l'apprentissage et aide à évaluer son impact sur la qualité et l'intégrité du travail. Cette page peut être supprimée en définissant l'option aiack comme false dans les options de la classe du document.

## **i** Exemple d'Utilisation

Je reconnais l'utilisation de ChatGPT (<https://chatgpt.com>) pour affiner le ton académique et améliorer la précision linguistique de ce travail, y compris les aspects de grammaire, ponctuation et vocabulaire.

## **Description de l'Utilisation**

**Instruction 1 :** Dans un paragraphe, décrivez simplement ce qu'est LaTeX.

**Réponse 1 :** LaTeX est un système de composition de haute qualité couramment utilisé pour produire des documents scientifiques et mathématiques grâce à sa gestion puissante des formules et bibliographies. Contrairement aux traitements de texte, il utilise des fichiers texte simples avec des balises de balisage pour définir la structure et le formatage d'un document, permettant un contrôle précis de la mise en page et de l'apparence. Il est particulièrement populaire dans le milieu académique et la recherche pour créer des thèses, articles de revues et présentations.



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# 1

## Introduction to the Template Motivation and First Steps

*Author : José Areia*

*Current Version : 2.2.10*

*License : L<sup>A</sup>T<sub>E</sub>X Project Public License v1.3c*

*Official Repository : [GitHub Repository](#)*

Welcome to the *IPL<sup>Leiria</sup> Thesis* template! Thank you for choosing it for your dissertation, report, or project. This template reflects many hours of development, and I hope you enjoy using it as much as I did creating it. This chapter introduces its purpose and helps you get started. See [chapitre 2](#) for a detailed guide, and [chapitre 3](#) for a brief L<sup>A</sup>T<sub>E</sub>X tutorial to maximise its use.

### 1.1 Motivation

I've been using L<sup>A</sup>T<sub>E</sub>X since 2020 for a wide range of purposes. Over time, I've reviewed over a hundred templates, and there's always something missing. *Always*. Powerful templates—*i.e.*, highly customisable with many options—are often poorly organised. Well-organised ones usually lack flexibility. Some even compile with errors and warnings. Most importantly, many aren't user-friendly. So, I created my own template for theses and reports, tailored to the Polytechnic University of Leiria. My goals were : *i*) clear and structured file organisation, *ii*) a clean, professional, and attractive design, *iii*) high customisability, and *iv*) ease of use, especially for beginners.

### 1.2 Getting Started

To start using this template, you first need to know how to use L<sup>A</sup>T<sub>E</sub>X. For this, please refer to [chapitre 3](#). Once you are familiar with L<sup>A</sup>T<sub>E</sub>X, you will need to either install it locally or use an online L<sup>A</sup>T<sub>E</sub>X editor.

If you prefer an online editor, I highly recommend **Overleaf**. While Overleaf offers a paid subscription for extended compilation time, this template is specifically designed to compile within the limits of the free subscription plan. To use the template in Overleaf, just refer to **official template page** and click *Use as Template*. But if you prefer to use a different version of it (which I do not recommend), you can do the following :

1. Download the **desired version** from the GitHub repository as a Zip file.
2. Login to your Overleaf account.
3. In your Project area, click in the menu and then : New Project → Upload Project.
4. Upload the Zip file.
5. Let Overleaf compile the document.

If you choose to use a local editor, you must first install  $\text{\LaTeX}$  on your machine. For this, there are several options, but I personally recommend either **TeX-Live** or **MikTeX**. After installing  $\text{\LaTeX}$ , you will need to select an editor for writing and editing your documents. To help with this decision, I suggest checking out this helpful **post**, which provides a comprehensive overview of various editors you can use. Once  $\text{\LaTeX}$  and your editor are set up, simply clone or download the **latest** version of the template from GitHub and start using it!

#### Tip

In the official GitHub repository, you'll find a **Makefile** and a **Latexmk configuration file**, either of which can be used to compile the project. The Makefile supports both rubber and latexmk as compilers, so you can choose the one that best suits your preferences.

## 1.3 Getting Help

As a newcomer, you may encounter situations where you want to do something in  $\text{\LaTeX}$  or with this template but aren't sure how. When questions arise, you have several options. First, you can read the wiki available in the **GitHub** repository for this template. Another great option is the **TeX Stack Exchange**, an active community that can help with nearly any issue. Of course, Google is always a reliable resource. If all else fails, feel free to contact me directly with any questions about the template. You can reach me at [jose.apareia@gmail.com](mailto:jose.apareia@gmail.com).

### 1.3.1 Issues, Feature Request and Suggestions

If, by any chance, you encounter a bug, have a suggestion, or would like to request a feature, you can submit them via the *Issues* tab in the **GitHub** repository. Please be

as descriptive as possible when reporting issues, and make sure to provide the appropriate labels to help me triage them effectively.

For feature requests or suggestions, you can either follow the steps mentioned above or, if you prefer, you can implement the feature yourself and submit a pull request. Both pull requests and pushes trigger a **GitHub Action** that will automatically compile the document. If the compilation fails, the pull request will be automatically rejected. Please keep this in mind and take care when submitting changes.

### 1.3.2 In-Built Comments, Guidance Texts and Warnings

Within this document template, you may encounter informational text displaying the message “Writing Guidance.” These sections are provided solely as guidance to help users understand what content should be included in specific sections. They are not related to the  $\text{\LaTeX}$  code itself within this template.

While navigating through the template, especially the configuration files, you will notice that everything is thoroughly commented.  $\text{\LaTeX}$  can sometimes be difficult to understand without proper documentation for the packages we are working with. With that in mind, I have made an effort to comment on all the changes I’ve made. Occasionally, I may forget or deem it unnecessary to comment on simpler changes, but more advanced modifications are always accompanied by detailed comments.

Finally, regarding warnings : please take them into consideration when compiling the document. As you may have noticed, the template is designed to be free of warnings, so please strive to maintain this clean compilation.

## 1.4 Important Notices

Although this template is specifically tailored for students from all six schools of the Polytechnic University of Leiria, you are welcome to use it if you are from a different institution. It is highly customisable and can be easily modified to suit the needs of other schools. If your school is interested in adopting this as the official template, please contact me first.

If you decide to use this template, please consider acknowledging it in your work. To do so, simply cite it using `\citep{IPLeiriaThesis}`. You can also show your appreciation for this template by giving a **star** on the GitHub repository. This helps increase its visibility, and you will receive notifications about the latest updates and releases. Either way, acknowledging this work, which involved significant effort and countless hours, would be greatly appreciated.

# 2

## Comprehensive User Guide Instructions for Using the Template

If you plan to use this template, please read this chapter carefully. It provides all the information you need to effectively use the template, including the mandatory modifications (*e.g.*, title, subtitle, author information) and other configurations that, while not highly recommended, are optional. The template comprises various directories and files, including a total of seven distinct directories and dozens of files. Among these, the most important are `IPLeiriaMain.tex` and `IPLeiriaThesis.cls`. Below, [tableau 2.1](#) presents the different directories available, along with their descriptions and a check-mark indicating whether you need to access the directory to make changes. Of course, the check mark indicates that you can make changes to the content, while a hyphen signifies that you should not modify it.

**TABLE 2.1** – Overview of the directory structure in this template.

Directory	Modifiable	Description
<i>Bibliography</i>	✓	This folder contains the bibliography file used to manage references throughout the document.
<i>Chapters</i>	✓	Individual chapters of the thesis are organised in this directory, making it easy to work on sections separately.
<i>Code</i>	✓	Code examples and relevant scripts are stored here, supporting the content of the thesis.
<i>Configurations</i>	-	All configuration files required for the template, such as layout and style settings, are placed in this directory.
<i>Figures</i>	✓	All figures and images referenced within the document are stored in this folder for easy access and management.
<i>Matter</i>	-	The front matter of the document, including the cover page, copyright statement, and glossary, is assembled in this directory.
<i>Metadata</i>	✓	This folder holds the metadata file, where key document details such as the author, title, and supervisor can be customised.

It is crucial to note that the files are organised according to a specific naming convention, which must be **respected** and **maintained**. The naming convention consists of an ascending two-digit numeric value, followed by a hyphen, and then the file name in capital letters. The name should always aim to be a single word. If more than one word is necessary, they should be separated by a hyphen and capitalised.

### Note

While [tableau 2.1](#) indicates that the *Matter* directory is not modifiable, two files within that directory should be altered when necessary : 04-Glossary.tex and 05-Acronyms.tex. Although the names are fairly self-explanatory, these files should contain the glossary and acronyms entries, respectively.

The two files mentioned earlier, `IPLeiriaMain.tex` and `IPLeiriaThesis.cls`, should be used with caution. The main file, as the name suggests, is the master file where you will add the necessary chapters to be included in your work. The class file, on the other hand, requires even more caution, and it is not recommended to alter it.

## 2.1 Template and Class Options

The first thing you need to do is specify the options within the `IPLeiriaMain.tex` file. How do you do that? It's simple. On the very first line, you will find a `documentclass` command that loads the custom class for this template. In this call, you can pass the options you need. The available options, presented in a key-argument style, are listed in [tableau 2.2](#).

`tabularx`  
`tabularx`

**TABLE 2.2** – Class options supported by the template.

Options	Description
<b>school=OPT</b> <i>eniad, esecs, esslei, esad, estm</i>	<b>Choosing a school and its corresponding logo.</b> ⇒ Default : <code>school=eniad</code> This option only modifies the school name and the corresponding logo, which will be displayed on the cover and front page.
<b>language=OPT</b> <i>french, english</i>	<b>Language preference selection.</b> ⇒ Default : <code>language=english</code>
<b>chapterstyle=OPT</b> <i>classic, modern, fancy</i>	<b>Selection of a cover design style.</b> ⇒ Default : <code>chapterstyle=classic</code> This option modifies the appearance of the chapter, including its title and numbering style. Explore the available styles and apply the one you prefer.
<b>coverstyle=OPT</b> <i>classic, bw</i>	<b>Choosing a style for the chapter.</b> ⇒ Default : <code>coverstyle=classic</code>

*Continued on the next page.*

Table 2.2 continued from previous page.

Options	Description
<b>docstage=OPT</b> <i>final, working</i>	<i>classic</i> → Put the cover on in the original red. <i>bw</i> → Make the cover black and white. <b>Choosing a stage for you document.</b> ⇒ Default : <code>docstage=final</code> <i>final</i> → Assumes this is the final version of the document. <i>working</i> → It assumes the document is a work in progress.
<b>media=OPT</b> <i>paper, screen</i>	<b>Project media type.</b> ⇒ Default : <code>media=paper</code> <i>paper</i> → Blank pages will appear between sections. <i>screen</i> → Blank pages will not appear between sections.
<b>linkcolor=OPT</b> <i>color</i>	<b>Main theme color.</b> ⇒ Default : <code>linkcolor=red!45!black</code> This option requires a valid color name. Refer to the xcolor manual (subsection 4.2) to select a valid color.
<b>bookprint=OPT</b> <i>true, false</i>	<b>For book printing.</b> ⇒ Default : <code>bookprint=false</code> This option adds a binding margin on odd-numbered pages to allow for printing, as it increases the left margin.
<b>aiack=OPT</b> <i>true, false</i>	<b>AI acknowledgement print.</b> ⇒ Default : <code>aiack=true</code> This option adds a section intended for the user to insert their acknowledgement of AI usage.

After setting the desired options in the main class, you are all set to personalise the metadata. To learn how, simply refer to [Section 2.2](#).

## 2.2 Metadata Customisation

While options like language and school can be passed as arguments to the main class, other options, such as author and title, must be defined manually. Since this template supports a wide range of metadata options, a dedicated file is provided for this purpose. The file at `Metadata/Metadata.tex` lists metadata variables, with comments on whether they are mandatory. Comment out the variables to omit them. [tableau 2.3](#) includes all metadata variables, their GET command, and if they are mandatory. The GET command automatically retrieves the information from the stored variable.

TABLE 2.3 – Metadata variables within the template.

Variable	Macro Commands	Mandatory
Title	<code>\GetTitle</code>	✓
Subtitle	<code>\GetSubtitle</code>	✓
University	<code>\GetUniversity</code>	✓

Continued on the next page.

Table 2.3 continued from previous page.

Variable	Macro Commands	Mandatory
School	\GetSchool	✓
Department	\GetDepartment	✓
Degree	\GetDegree	✓
Course	\GetCourse	-
Local and date	\GetDate	✓
Academic year	\GetAcademicYear	✓
Thesis type ( <i>Dissertation, Project or Internship</i> )	\GetThesisType	✓
First author name	\GetFirstAuthor	✓
First author identification	\GetFirstAuthorNumber	✓
Second author name	\GetSecondAuthor	-
Second author identification	\GetSecondAuthorNumber	-
Third author name	\GetThirdAuthor	-
Third author identification	\GetThirdAuthorNumber	-
Supervisor name	\GetSupervisor	✓
Supervisor e-mail	\GetSupervisorMail	✓
Supervisor title and affiliation	\GetSupervisorTitle	✓
Co-supervisor name	\GetCoSupervisor	-
Co-supervisor e-mail	\GetCoSupervisorMail	-
Co-supervisor title and affiliation	\GetCoSupervisorTitle	-
Second co-supervisor name	\GetSecCoSupervisor	-
Second co-supervisor e-mail	\GetSecCoSupervisorMail	-
Second co-supervisor title and affiliation	\GetSecCoSupervisorTitle	-

If, by any chance, **you want to add more options**, please contact me by opening an issue in the official GitHub repository or via the email provided in this document.

## 2.3 Custom Chapter Insertion

As stated before, to use this template, you need to do three things : set the appropriate options in the document class (see [Section 2.1](#)), update the document metadata (see [Section 2.2](#)), and create and import your custom chapters. To create and import a custom chapter, follow these steps : *i* create a TeX file in the Chapters directory that follows the predefined naming convention and *ii*) include it in the main file using the command `\include{CHAPTER}`. And voilà, your first chapter is ready!

## 2.4 Custom Commands

Within this template, some custom commands are also available for your use. For example, if you are writing your thesis and want to add a to-do note, you can easily



insert a block with the option `todo`, as follows : `\begin{block}[todo]`. This will insert a to-do block with a style similar to Markdown. Other available options are : `tip`, `warning`, and `note`. Below is a visual example for each one.

**To-Do**

This is a to-do block.

**Tip**

This is a tip block.

**Warning**

This is a warning block.

**Note**

This is a note block.

# 3

## Essential LaTeX Tutorial Fundamentals and Key Concepts

This chapter introduces the  $\text{\LaTeX}$  working environment and the essentials for producing your thesis.  $\text{\LaTeX}$  (pronounced “LAY-tek” or “LAH-tek”) is a tool for creating professional documents using plain text with formatting commands, unlike WYSIWYG editors like Microsoft Word. These files are processed by a TeX engine to generate a polished PDF, allowing you to focus on content while  $\text{\LaTeX}$  handles the layout. While this chapter covers key features, it’s worth learning  $\text{\LaTeX}$  from the start. For a quick introduction, see Overleaf [Learn LaTeX](#) series for guidance.

### 3.1 Citations

We present two distinct approaches for citing entries in the bibliography. The first method involves in-text citations, executed using `\citet{ENTRY}`, while the second method employs `\citep{ENTRY}` for citations within a paragraph. Below is an example that demonstrates both usages. You can cite multiple works in the same citation environment using `\citep{ENTRY1, ENTRY2, ...}`. For citing only the title, use `\citetitle{ENTRY}`, and for the author, use `\citeauthor{ENTRY}`.

#### Tip

Proper citations are vital in academic writing and ensure credibility, transparency, and knowledge advancement. They are essential for responsible scholarship. Ensure accuracy and appropriateness.

**Example :** A novel signature scheme is introduced, along with an implementation of the Diffie-Hellman key distribution scheme that accomplishes a public key cryptosystem (ELGAMAL, 1985). According to ELGAMAL (1985), a new signature scheme that accomplishes a public key cryptosystem is introduced (...) This template was created by José

AREIA, with the title *Polytechnic University of Leiria : LaTeX Thesis Template*.

## 3.2 References

Much like citations, it is advisable to employ references in your document for citing crucial elements such as chapters, sections, figures, or tables. To reference these elements, begin by creating a label. This label can be generated using `\label{TEXT}`, and it should be positioned within the element you intend to refer to. Once the element is created, you can utilise `\ref{LABEL}` to generate an in-text reference. **We strongly recommend using `\autoref{LABEL}`**. This command automatically creates a custom link with color corresponding to the type of element being referred to. For instance, a chapter reference will appear like this : **chapitre 1**, rather than simply Chapter 1.

### Tip

Properly referencing elements within the document, such as **chapters, sections, figures, tables, or listings**, is crucial.

## 3.3 Glossary, Acronyms and Symbols

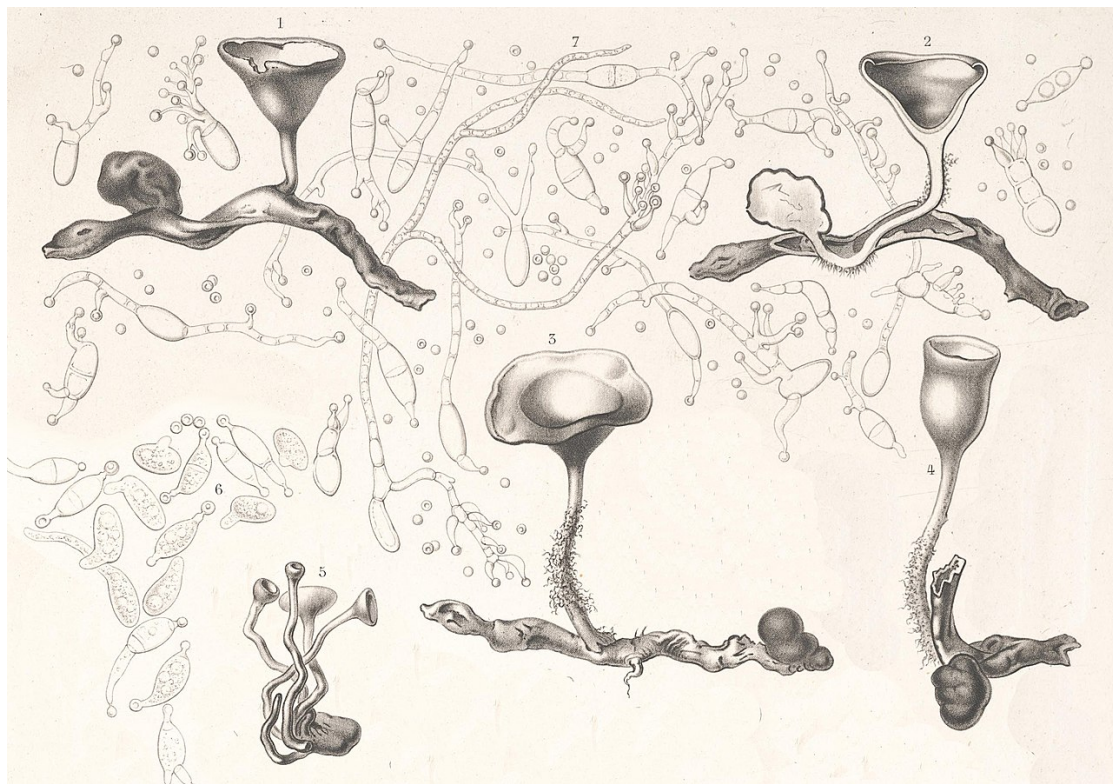
The document includes a glossary, and an acronym and symbol list, accessible at the beginning of the document. You can create a new entry in either the `Matter/05-Glossary`, `Matter/06-Acronyms` or `Matter/07-Symbols` sections, depending on the type of entry you intend to add. Once the entry is created, you can reference it using `\gls{ENTRY}` for both glossary and symbol entries. For acronym entries, there are two ways to reference them. The first method, `\acrfull{ENTRY}`, should be used the first time the acronym appears in the text as it automatically provides the definition in-text. Subsequently, to refer to the acronym without repeating its meaning, use `\acrshort{ENTRY}`.

**Example :** Utilising **Latex** for **Mathematics** is essential (...). It is advisable to seek both the **Greatest Common Divisor (GCD)** and **Least Common Multiple (LCM)** because (...). Subsequently, with the aid of **GCD** and **LCM**, we can find both  $\alpha$  and  $\beta$  (...).

## 3.4 Figures

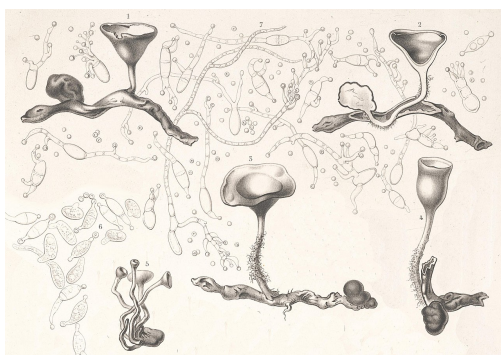
In  $\text{\LaTeX}$ , integrating figures is a straightforward process. To insert them, you should utilise the environment `\begin{figure}`. You can customise the width parameter according to your requirements, but it is crucial to select a high-quality figure when inserting it into your documents. It is equally crucial to furnish a well-crafted caption. If necessary, consider including citations or references to indicate the figure's origin. The caption environment is denoted as `\caption{TEXT}`. To generate a smaller caption for the Table of Figures, be sure to utilise the format `\caption[SMALL_TEXT]{BIG_TEXT}`.

By following the aforementioned tips, we can create a figure as demonstrated in [figure 3.1](#).

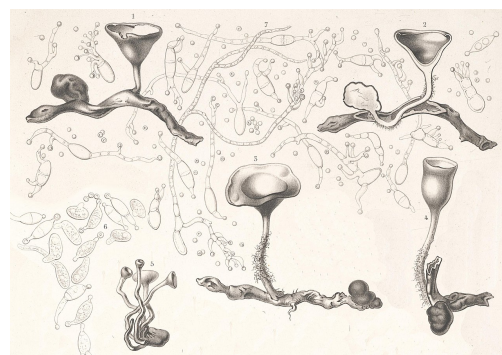


**FIGURE 3.1** – Illustration of the fungus *Dumontinia tuberosa* by physician, mycologist, and illustrator Charles Tulasne (1816–1884) in the book *Selecta Fungorum Carpologia* (1861–65). (Name of the original work : *Peziza tuberosa* parasite on *Anemone nemorosa*).

For comparison or for other reasons, you can insert side-by-side figures using both the `\begin{figure}` and `\begin{subfigure}` environments. You can also refer to the sub-figure as [figure 3.2a](#) and [figure 3.2b](#).



(a) Caption for figure 1.



(b) Caption for figure 2.

**FIGURE 3.2** – Overall caption of the figure.

## 3.5 Tables

Tables are vital for presenting findings effectively. This chapter explores techniques for conveying information through tables using various template environments. Defining tables in  $\text{\LaTeX}$  seems complex, but this template simplifies the process.

### Tip

Different table environments must be within a `\begin{table}` environment and use `[!htpb]` float options for better placement. **This advice should be taken into consideration when positioning figures as well.**

### 3.5.1 Tabular Environment

The conventional `\begin{tabular}` environment enables you to create a simple yet elegant table. [tableau 3.1](#) is generated using a centering environment for added emphasis. It also incorporates the `booktab` configuration for a more sophisticated table style.

**TABLE 3.1** – *A table showcasing the usage of the tabular environment.*

Header 01	Header 02	Header 03
Lorem Ipsum	Pharetra Dolor	✓
Amet Consectetuer	Curabitur Aliquet	-
Praesent Mauris	Praesent Libero	✓

### 3.5.2 Tabularx Environment

Employ the `\begin{tabularx}` package to construct a table featuring automatically expanding multi-columns. To achieve this automatic behaviour for multi-columns, you can use the following environment : `\begin{tabularx}{\textwidth}{lX}`, where X is the column that will function as a multi-column. Use C to centre the multi-column, and L and R to align left and right respectively. [tableau 3.2](#) showcases the usage of the `\begin{tabularx}` environment.

### 3.5.3 Longtable Environment

At times, when dealing with exceptionally lengthy tables, it becomes necessary to split them across multiple pages. In  $\text{\LaTeX}$ , this can be achieved using the `\begin{longtable}` environment. This environment is slightly more complex than others, as you need to define the header twice : once for the initial appearance of the table and again for when the table spans additional pages. This repeated header ensures the reader can correctly identify the columns on subsequent pages. Feel free to consult [tableau 3.3](#) for a detailed demonstration of how the `longtable` environment works.

**TABLE 3.2** – *A table showcasing the usage of the tabularx environment.*

Header 01	Header 02
Foo Bar Baz	Quisque cursus, metus vitae pharetra auctor, sem massa mattis sem, at interdum magna augue eget diam.
Ipsum Dolor	Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Curabitur aliquet quam id dui.
Dolor Sit	Phasellus condimentum elementum justo, quis interdum est sagittis ac. Vestibulum non arcu sit amet justo lobortis semper.
Amet Consectetuer	Integer nec odio praesent libero sed cursus ante dapibus diam sed nisi vestibulum non arcu.

**TABLE 3.3** – *A table showcasing the usage of the longtable environment.*

Names	E-Mails	Job/Role
Alice Johnson	alice.johnson@email.com	Project Manager
Bob Thompson	bob.thompson@email.com	Data Analyst
Charlie Davis	charlie.davis@email.com	Marketing Specialist
David Miller	david.miller@email.com	QA Tester
Emily White	emily.white@email.com	Graphic Designer
Frank Martin	frank.martin@email.com	HR Coordinator
Grace Turner	grace.turner@email.com	Financial Analyst
Henry Lee	henry.lee@email.com	System Administrator
Ivy Carter	ivy.carter@email.com	Customer Support
Jack Wilson	jack.wilson@email.com	Frontend Developer
Jane Reed	jane.reed@email.com	UX Designer
Kevin Evans	kevin.evans@email.com	Product Manager
Linda Adams	linda.adams@email.com	Accountant
Mike Hill	mike.hill@email.com	Network Engineer
Nina Garcia	nina.garcia@email.com	Business Analyst
Oliver Smith	oliver.smith@email.com	Sales Representative
Pamela Turner	pamela.turner@email.com	Legal Counsel
Quincy Brown	quincy.brown@email.com	IT Consultant
Rachel Moore	rachel.moore@email.com	Content Writer
Samuel White	samuel.white@email.com	Research Scientist
Amy Harris	amy.harris@email.com	Digital Strategist
Brian Cook	brian.cook@email.com	Operations Manager
Catherine Ross	catherine.ross@email.com	Brand Manager
Daniel Green	daniel.green@email.com	Database Administrator
Emma Taylor	emma.taylor@email.com	Social Media Manager
Felix Carter	felix.carter@email.com	Compliance Officer
Gloria Scott	gloria.scott@email.com	Procurement Specialist
Harold Bennett	harold.bennett@email.com	DevOps Engineer

*Continued on the next page.*

Table 3.3 continued from previous page.

Names	E-Mails	Job/Role
Isla Cooper	isla.cooper@email.com	User Researcher
James Black	james.black@email.com	Mobile App Developer
Katie Brown	katie.brown@email.com	UI Designer
Leo Perez	leo.perez@email.com	Scrum Master
Megan Clark	megan.clark@email.com	Event Coordinator
Nathan Ward	nathan.ward@email.com	Security Analyst
Olivia Harris	olivia.harris@email.com	Corporate Trainer
Paul King	paul.king@email.com	Territory Manager
Queen Foster	queen.foster@email.com	Paralegal
Rebecca Adams	rebecca.adams@email.com	Copy Editor
Steven Martin	steven.martin@email.com	Robotics Engineer

### 3.5.4 Complex Tables

Creating intricate tables in  $\text{\LaTeX}$  can be a somewhat challenging task. Therefore, we highly recommend using the **Table Generator**. With this tool, you can design your table with the desired style and then easily copy and paste it into your document. This approach simplifies the process and helps ensure the accurate representation of complex tables in your  $\text{\LaTeX}$  document. However, it's crucial to keep in mind that a table should be easily comprehensible for the reader and should not be overly complex. **The complexity of a table may impede understanding.** For example, **tableau 3.4** presents a table with intricate details.

TABLE 3.4 – A table showcasing the usage of the complex tables.

Component	Specifications	
	Characteristic	Supported
CPU	Core Count (e.g., 8 Cores)	✓
	Clock Speed (e.g., 3.6 GHz)	✓
	Hyper-Threading	✓
	Integrated Graphics	-
GPU	CUDA Cores (e.g., 5120)	✓
	Base Clock (e.g., 1.5 GHz)	✓
	Ray Tracing Support	✓
	Multi-GPU Support (SLI/CrossFire)	-
Memory	Type (e.g., DDR5, GDDR6)	✓
	Capacity (e.g., 16 GB)	✓
	Memory Bandwidth (e.g., 448 GB/s)	✓
	ECC Support	-
Motherboard Features	PCIe 5.0 Support	✓
	Wi-Fi 6E	✓
	Thunderbolt 4	-



## 3.6 Lists

Creating lists in  $\text{\LaTeX}$  is straightforward, offering various options to suit your needs. You can generate a bullet list using `\begin{itemize}`, or opt for a numbered list with `\begin{enumerate}`. Below is an example with the `\begin{itemize}` environment.

- List entries start with the `\item` command.
- Individual entries are indicated with a black dot, a so-called bullet.
- The text in the entries may be of any length.

As mentioned earlier, you can generate a numbered list using the `\begin{enumerate}` environment. Here is an example :

1. Items are numbered automatically.
2. The numbers start at 1 with each use of the `enumerate` environment.
3. Another entry in the list.

You can also nest list entries by creating a list inside another list of the same type. Here is an example :

1. First level item
2. First level item
  - (a) Second level item
  - (b) Second level item
    - i. Third level item
    - ii. Third level item

### Tip

Please note that the labels change automatically regardless of the environment being the same for every list. **This demonstrates that there's no need to worry about changing the environment for something different.**

You can also modify the label of your list to something entirely different that suits your needs. To accomplish this, insert a new `\item` and enclose your desired label in square brackets. For example, `\item[!]` will result in an exclamation point as your new label. Below are some examples of modified labels.

- This is my first point
- Another point I want to make
- ! A point to exclaim something!
- Make the point fair and square.
- A blank label?

Finally, you can create a description list. Unlike having a bullet point or a numbered label, a description list enables you to use custom descriptions that suit your list. In



the example below, there are three `\item` entries : one without a label, and two with descriptions.

**Item 1 :** This is the first item with a description.

**Item 2 :** Another item with a different description.

An item without a specific label.

### 3.7 Code Listings

At times, you may want to include source code from your programs and applications within your document. To achieve this, you can use two nested environments : `\begin{listing}` to create a listing with both caption and label, and `\begin{minted}` for code highlighting. [Listage 1](#) provides an example of a source code in C.

**Listage 1** – *Hello world in C.*

---

```

1 #include <stdio.h>
2 int main() {
3     printf("Hello, World!"); /* printf() outputs the quoted string */
4     return 0;
5 }
```

---

The code mentioned above was inserted into the document. However, an alternative approach is to input your code from an external file. To do so, you just need to use the command `\inputminted{CODE_LANGUAGE}{FILE}`. Of course, you should place that command inside of the `\begin{listing}` environment. [Listage 2](#) illustrates an example of Haskell source code that has been input from an external file.

**Listage 2** – *Factorial in Haskell.*

---

```

1 -- Factorial function
2 factorial :: Integer -> Integer
3 factorial 0 = 1 -- Base case: 0! = 1
4 factorial n = n * factorial (n - 1) -- Recursive case
5
6 -- Main function to test the factorial
7 main :: IO ()
8 main = do
9     putStrLn "Enter a number:"
10    input <- getLine
11    let number = read input :: Integer
12    print (factorial number)
```

---

In some cases, when you simply want to highlight a specific command, it's recommended not to use `listing` or `minted`. Instead, you should utilise the `\verb` command for inline highlighting or the `\begin{verbatim}` environment for longer sections of

highlighted code. An example of a lengthy verbatim section is provided below, demonstrating how to create a listing with an input code :

```
\begin{listing}[!htpb]
  \inputminted{CODE_LANGUAGE}{FILE}
  \caption{TEXT}
  \label{TEXT}
\end{listing}
```

Sometimes it is necessary to display longer code that occupies more than one page. For this purpose, please use the environment `\begin{longlisting}`. This environment will easily break your code into multiple pages for better readability without you worrying about the size of your code. An example is shown below in [Listage 3](#).

**Listage 3** – *A sample of functions in Lisp.*

---

```
1 (defun factorial (n)
2   "Calculate the factorial of a number."
3   (if (zerop n)
4       (* n (factorial (1- n)))))
5
6 (defun fibonacci (n)
7   "Calculate the nth Fibonacci number."
8   (cond ((zerop n) 0)
9         ((= n 1) 1)
10        (t (+ (fibonacci (1- n)) (fibonacci (- n 2))))))
11
12 (defun gcd (a b)
13   "Calculate the greatest common divisor of a and b."
14   (if (zerop b)
15       a
16       (gcd b (mod a b))))
17
18 (defun primes-up-to (limit)
19   "Return a list of all prime numbers up to LIMIT."
20   (let ((primes '()))
21     (loop for i from 2 to limit
22           unless (some (lambda (p) (zerop (mod i p))) primes)
23             do (push i primes))
24     (nreverse primes)))
25
26 (defun example-function (x)
27   "An example function to demonstrate Lisp capabilities."
28   (let ((result (list (factorial x)
29                       (fibonacci x)
30                       (gcd x 10)
31                       (primes-up-to x))))
32     (format t "Factorial of ~A: ~A~%" x (factorial x))
33     (format t "Fibonacci of ~A: ~A~%" x (fibonacci x))
34     (format t "GCD of ~A and 10: ~A~%" x (gcd x 10))
```

---

```

35     (format t "Primes up to ~A: ~A~%" x (primes-up-to x))
36     result))
37
38 (example-function 10)

```

---

## 3.8 Equations

When writing equations and other mathematical expressions,  $\text{\LaTeX}$  is a powerful and versatile tool. You can enter a formula in inline mode using the environment `\(FORMULA\)` or use `\begin{equation}` to display it in “math mode” with numbering. If you prefer not to display the equation number, you can use the environment `\[FORMULA\]`.

**Example :** In physics, the mass-energy equivalence is expressed by the equation  $E = mc^2$ , discovered in 1905 by Albert Einstein. In natural units ( $c = 1$ ), the formula (3.1) expresses the identity :

$$E = m \tag{3.1}$$

**Example :** Below is a equation – *without numbering* – for the regularised loss function in supervised learning, combining the average prediction loss over the training dataset and an  $L_2$  regularisation term to prevent overfitting :

$$\mathcal{L}(\theta) = \frac{1}{N} \sum_{i=1}^N \ell(y_i, f(\mathbf{x}_i; \theta)) + \lambda \|\theta\|_2^2$$

Equations can be a bit challenging to create, so we advise using an online editor, like the [LaTeX Equation Editor](#). Simply build your formulas there and copy and paste them into your document, either inline or in a math block, as shown above.

## 3.9 Footnotes

Sometimes it is important to present information that is not central to the main text in a footnote. In  $\text{\LaTeX}$  this can be easily achieved using the command `\footnote{TEXT}`. The text will appear at the bottom of the page<sup>1</sup>.

If you want to use footnotes within tables, it is best to reconsider, as  $\text{\LaTeX}$  does not provide an easy way to handle them. Instead, you can place a “\*” wherever you want the footnote reference to appear. Then, below the table **but before ending the table environment**, place the “\*” along with the footnote text. This will create a similar footnote, but it will appear below the table rather than at the bottom of the page.

---

1. This is a simple footnote.



# Bibliography

ELGAMAL, T. (juill. 1985). « A public key cryptosystem and a signature scheme based on discrete logarithms ». In : *IEEE Transactions on Information Theory* 31.4, p. 469-472. ISSN : 1557-9654. DOI : [10.1109/TIT.1985.1057074](https://doi.org/10.1109/TIT.1985.1057074). URL : <https://ieeexplore.ieee.org/document/1057074>.

JOSÉ AREIA (déc. 2023). *Polytechnic University of Leiria : LaTeX Thesis Template*. URL : <https://github.com/joseareia/ipleiria-thesis>.



# Annexes







## Showcasing the First Appendix

### Orientation pour l'Écriture

Appendices contain supplementary material **created by the author** that enhances the reader's understanding of the dissertation while not being essential for following the primary narrative. These sections often include detailed tables, figures, complex calculations, or materials like survey questions and interview transcripts produced in the course of the research. The appendices allow readers to explore the research in greater detail, offering a deeper insight into methods and findings without interrupting the main body of work.

# B

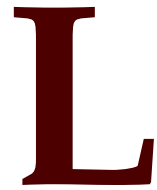
## Showcasing the Second Appendix

Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper. Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper. Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper. Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.



## Annexes





## Showcasing the First Annex

### Orientation pour l'Écriture

Annexes are supplementary sections in a dissertation that provide additional information or external documents not essential to the main arguments but that support or complement the research. Unlike appendices, **annexes generally contain material that was not developed by the author**, such as reports, legal documents, or published datasets from external sources. This information is placed separately to keep the main content concise, allowing readers access to relevant external references without disrupting the dissertation's flow.



