UNIVERSIDAD POLITÉCNICA DE MADRID

Escuela Técnica Superior de Ingenieros Informáticos

Thesis Title, Uppercase Letters for All Non-Connector Words (Articles, Prepositions, Conjunctions, etc.)

DOCTORAL THESIS

Submitted for the degree of Doctor by:

<<Name and surnames>>

<<Previous academic degree>>

Madrid, 2023

UNIVERSIDAD POLITÉCNICA DE MADRID

Escuela Técnica Superior de Ingenieros Informáticos

Doctoral Degree in Software, Systems and Computing

Thesis Title, Uppercase Letters for All Non-Connector Words (Articles, Prepositions, Conjunctions, etc.)

DOCTORAL THESIS

Submitted for the degree of Doctor by:

<<Name and surnames>>

<<Previous academic degree>>

Under the supervision of:

Dr. <<Supervisor name and surnames>>

Dr. <<Co-supervisor name and surnames, if applicable>>

Madrid, 2023

Title: <<Title of the doctoral thesis, which must be identical to the title that appears on the THESIS platform>>

Author: <<Name and surnames>>

Doctoral Programme: Software, Systems and Computing

Thesis Supervision:

> Dr. <<Supervisor name and surnames, position, institution>>

> Dr. <<Co-supervisor name and surnames, position, institution, if applicable>>

External Reviewers:

Thesis Defence Committee:

Thesis Defence Date:

<<If the thesis has received funding from any competitive call, please state it here by writing: "This thesis has been partially supported by…". Otherwise, delete this text to leave this section blank>>

<<A page with a dedication may be optionally included.>>

Acknowledgements

<<A page with acknowledgements may be optionally included.>>

Abstract

<<Abstract of the thesis in English. Maximum length of 4000 characters, plain text (without symbols). Structured summary of the thesis (introduction or motivation, objectives, findings, and conclusions).>>

Resumen

<<Resumen de la Tesis en español. Longitud máxima: 4000 caracteres en texto plano (sin caracteres especiales). Debe ser un resumen estructurado de la Tesis (introducción o motivación, objetivos, hallazgos y conclusiones).>>

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Abbreviations and Acronyms

APA	American Psychological Association
DIN	*Deutsches Institut für Normung*
DSSC	*Doctorado en Software, Sistemas y Computación* (PhD in Software, Systems and Computing)
ETSIInf	*Escuela Técnica Superior de Ingenieros Informáticos*
JCR	Journal Citation Reports
PDF	Portable Document Format
UPM	*Universidad Politécnica de Madrid*

1 INTRODUCTION

The thesis introduction must include the context in which it was conducted and the reasons for completing it.

This template shows the basic structure for the final thesis, as well as some instructions for format, in accordance with the Universidad Politécnica de Madrid (UPM) doctoral thesis formatting guidelines [UPM, 2023b]. Using a template helps to use the same format throughout the entire thesis.

In the next chapter we provide more information about the rules for preparing the thesis document and the use of this template.

2 STATE OF THE ART

This chapter is devoted to describing previous works related to the thesis topic. Based on supervisors' instructions, the chapter must contain the background and the theoretical foundation necessary to understand the rest of the document and other works related to the thesis.

It is highly recommended that the State of the Art (which may also be called Related Work) be structured into paragraphs and sections by theme, and not to include its content in other chapters of the thesis.

The following sections present the formatting instructions for the thesis report.

2.1 How to use this template

This template has been developed in accordance with the UPM doctoral thesis formatting guidelines, which –in many respects– follow formatting standards common to many institutions.

The thesis document is divided into three components (front matter, main matter, and end matter), each of which has several subcomponents, as shown in Table 2.1.

Table 2.1. Components of the thesis document

Components	Subcomponents
Front matter	Cover Front page Credits page [Dedication] [Acknowledgment] Abstract / *Resumen* Table of Contents List of Figures List of Tables Abbreviations and Acronyms
Main matter	Introduction State of the Art Central chapters specific of each thesis Conclusions Future Lines of Research
End matter	References Annexes

Most formatting rules refer to the front matter, that is, the initial pages that appear before the chapters of the thesis (the main body of the thesis).

Mandatory rules and some recommendations are presented in the next sections.

2.2 Mandatory rules

The **key rules** to remember are:

- The first three pages (cover, front page, and credits page) must use the format specified in this template.
- The initial pages are mandatory, except for dedication and acknowledgment.
- The thesis is submitted in electronic format (PDF).

2.2.1 Cover

The cover page is the first page of the PDF document:

- It must be prepared using this template, entering the title and the appropriate data in the sections marked with << >> and without including other information.
- The full names of the University and the School must appear.
- The coat of arms of the UPM (Figure 2.1) should be used, not the logotype (Figure 2.3).
- The title of the thesis must match exactly with the title registered in THESIS [UPM, 2023c]. In case you wish to modify the registered title, you must request it through THESIS before the application for the Assessment prior to PhD thesis submission [DSSC, 2023b].
- It must include the full name of the PhD student, as registered in THESIS, together with the university qualification for access to doctoral studies.
- At the bottom of the page, the year in which the application for the deposit of the thesis is made must be included.

Figure 2.1: Coat of arms of the UPM

2.2.2 Front Page

The front page of the PDF document should be:

- It must be prepared using this template, entering the title and the appropriate data in the sections marked with << >> and without including other information.
- It must include the coat of arms of the UPM (Figure 2.1) and the coat of arms of the ETSIInf (Figure 2.2).
- The full names of the University and the School must appear.
- The full name of the Doctoral Programme must be included.
- It must include the full name of the PhD student, as registered in THESIS, together with the university qualification for access to doctoral studies.
- It must include the full names of the thesis supervisors.

- At the bottom of the page, the year in which the application for the deposit of the thesis is made must be included.

Figure 2.2: Coat of arms of the ETSIInf

2.2.3 Credits

The credits page of the PDF document will be numbered as page i:

- It must be prepared using this template, entering the appropriate data in the sections marked with << >> and without including other information.
- The title of the thesis, the author's full name and the name of the PhD Programme must be included.
- The full names of the thesis supervisors must be included, together with additional data: position and institution.
- The sections "External Reviewers", "Thesis Defence Committee" and "Thesis Defence Date" are always left blank.
- If the thesis has received funding from a competitive call, this should be indicated at the bottom of this page.

2.2.4 Abstract

This will be followed by the abstract and the resumen:

- An abstract must be included in both Spanish and English, regardless of the language of the thesis.
- Format: maximum 4000 characters, plain text (no symbols).
- Structure: the abstract is a presentation of the thesis and, therefore, it must have a clear structure, including introduction (or motivation), objectives, development, and conclusions.

2.3 Recommendations

Generally, the content of the thesis (Table 2.1) covers several chapters, whose number and structure may vary depending on the thesis topic and whether it is a manuscript or a thesis as a compendium of publications (section 2.3.3.1).

Ideally each chapter is organized into sections and subsections, with numbered headings.

2.3.1 Main matter of the thesis

This template includes the following chapters for the main body of the thesis (Table 2.1) as a guide:

- Introduction
- State of the art
- Presentation of the problem (with proposed objectives and hypotheses).
- Proposed solution (there may be several chapters addressing separate aspects of the solution).
- Results.
- Conclusions.
- Future lines of research.

In any event, thesis supervisors shall instruct their students as to the structure of the final thesis that best adapts to the work the student has completed.

2.3.2 End matter of the thesis

The end matter of the thesis (Table 2.1) comprises:

- References (publications used in the study and development of the thesis).
- Annexes (optional).

References should be included using any style recommended for Computer Science.

We recommend structuring the references in alphabetical order of the author's surname, and it must include the authors, year of publication, complete title of the publication and complete title of the journal, congress, or book, etc. To avoid large spaces between words, the text in this chapter need not be justified.

The annexes may include additional material not included in the main text (questionnaires, additional results, etc.). It is recommended to number the annexes alphabetically (A, B...) and start each annex on a different page. In case of including tables or figures in annexes, a new numbering will be used independent of that of the main body of the thesis (Table A.1...).

2.3.3 Format guidelines

In terms of format, the following guidelines should be followed, as shown in this template:

- *Language*: the thesis can be written in Spanish or English.
- *Other languages*: terms, sentences, and expressions in a language other than the main language of the thesis should appear in italics.
- *Paper size*: DIN A4.
- *Margins*: upper, lower, left-hand, and right-hand 2.5 cm.
- *Paragraphs*: preferably with line breaks and not indented. Text must be justified. Spacing must be between 1 and 1.5.
- *Font for text*: due to its clarity and legibility, "Bookman Old Style", font size 11, in black, is recommended. If not possible, recommended alternatives are: "Palatino Linotype", "Century", "Garamond", "**Georgia**", "Times New Roman", or "Book Antiqua."
- *Font for source code*: "Consolas", "Roboto mono" or "Courier."
- *Chapter titles*: in uppercase letters with Arabic numerals.

- *Sections and subsections*: shown with decimal numbers following the chapter number. E.g.: subsection 2.3.3.1.
- *Citations*: all sentences or text literally copied from another source must be in quotes (preferably with "double quotes"), referencing the original publication, which must be listed in the References chapter.
- *Mathematical expressions*: we recommend putting them into independent, centred paragraphs and they can be numbered with Arabic numerals to the right in parenthesis. Numbering may be corollary for the entire document (1, 2…) or independent within each chapter (3.1, 3.2…).
- *Figures, tables, and codes*: all figures, tables, and code fragments must be accompanied by their heading ("Figure," "Table", "Code…"), order number, and brief description or title. Numbering may be consecutive for the entire document (Figure 1, Figure 2…) or, best, within each chapter (Figure 1.1, Figure 1.2…). All figures, tables, and code must be referenced in the text (for example, Figure 2.1 shows the UPM's coat of arms and Figure 2.3 its logotype). Figures and tables must be preferably centred. We recommend using 9 or 10-sized unjustified font for text in tables.
- *Page headers*: the header of odd-numbered pages should contain the name of the chapter on the right; the header of even-numbered pages should contain the name of the author of the thesis on the left. Headers may have a horizontal separator line. The footer should contain only the page number.
- *Page numbers*: always centred at the bottom margin; page 1 starts at chapter 1; all previous sections, between the credits and chapter 1, should be numbered in lower case Roman numerals (i, ii, iii…).

Figure 2.3: UPM logotype

Special care must be taken to avoid spelling mistakes or typos and to write with proper syntax and technically sound. Compliance with a uniform format throughout the document should also be monitored. Remember that once the thesis has been deposited [DSSC, 2023a], it is considered the definitive thesis and absolutely no modifications may be made.

2.3.3.1 Thesis as a compendium of publications

You may also opt to structure the thesis by following the model for the Compendium of Publications [UPM, 2017].

A thesis has been written based on the Compendium of Publications model when the section devoted to the Solution fundamentally consists of the (total or practically literal) reproduction of articles (either entirely or partially) written by the author of the thesis, published while completing it.

In this case, the thesis must include unpublished material (more than 18,000 words), including an abstract (in Spanish and in English), general introduction, state of the art, objectives and hypothesis, methodology, collection of at least three publications, a general discussion (with a description of the solution, analysis of results, conclusions, and future lines of research) and bibliography. To opt for this method of writing the thesis, the thesis author must be the first author of three articles published in journals on JCR lists [Clarivate, 2023] in positions Q1 or Q2, and must appear as affiliated with the "Universidad Politécnica de Madrid."

3 PRESENTATION OF THE PROBLEM

Chapter devoted to describing the problem that the thesis seeks to solve, clearly stating the proposed objectives and hypotheses or research questions addressed by the thesis. It may also be entitled Hypothesis.

4 SOLUTION

Chapter devoted to describing the proposed solution in the thesis for the problem presented in the previous chapter. Based on supervisor instructions, this chapter may have different hierarchical structures, and there may even be several chapters to address different parts of the solution.

The research methodology used can be provided in a section of this chapter or in a previous additional chapter.

Moreover, a section or even a chapter may be included that is devoted to the thesis' experimentation, providing principal results in the following chapter.

5 RESULTS

Summary and discussion of the principal results obtained in experimentation and in the thesis.

An analysis of the results must be conducted, using principal contributions stemming from the thesis' topic as a reference.

Publications by the student that stem from the thesis may also be included as thesis results.

6 CONCLUSIONS

Summary of the doctoral thesis' main conclusions, as well as the student's personal conclusions regarding the work carried out.

This chapter shall present the study's main findings and the proposals stemming therefrom, after considering the results obtained. The conclusions chapter must meet the thesis' objectives and verify that they were fulfilled.

7 FUTURE LINES OF RESEARCH

After presenting the solution to the proposed problem and results and conclusions, this chapter must propose main lines of research opened by this thesis, or possible work that could be undertaken a posteriori.

The limits of research and an analysis on how they might be resolved, as well as suggestions for improvement, may also be presented.

REFERENCES

This chapter includes the publications used in the study and development of the thesis, which should be referenced in the other chapters.

We recommend structuring the bibliography in alphabetical order of the author's surname, and it must include the authors, year of publication, complete title of the publication and complete title of the journal, congress, or book, etc. We recommend using an international system for bibliographical references, based on the supervisor's instructions (for example, the IEEE system [IEEE, 2009], APA [APA, 2023]…). Recommendations set forth by the UPM Library may also be followed [UPM, 2023].

[APA, 2023] American Psychological Association: APA Style: References, 2023 [retrieved 28-12-2023]. Available at: https://apastyle.apa.org/style-grammar-guidelines/references

[Clarivate, 2023] Clarivate: Journal Citation Reports, 2023 [retrieved 17-2-2023]. Available at: https://jcr.clarivate.com/

[DSSC, 2023b] PhD in Software, Systems and Computing: PhD Thesis. [retrieved 28-12-2023]. Available at: https://dssc.fi.upm.es/en/tesis.php

[DSSC, 2023b] PhD in Software, Systems and Computing: Procedures. [retrieved 28-12-2023]. Available at: https://dssc.fi.upm.es/en/tramites.php

[IEEE, 2009] IEEE [Institute of Electrical and Electronics Engineers]: IEEE Citation Reference, 2009 [retrieved 17-2-2023]. Available at: https://www.etsiinf.upm.es/docs/estudios/grado/1475_ieeecitationref.pdf

[UPM, 2017] Universidad Politécnica de Madrid: Tesis por Compendio, 2017 [retrieved 31-7-2023]. Available at: https://www.upm.es/sfs/Rectorado/Vicerrectorado%20de%20Investigacion/Doctorado/Normativa/Documentos/Tesis%20por%20compendio.pdf

[UPM, 2023a] Universidad Politécnica de Madrid: Cómo citar bibliografía, 2023 [retrieved 17-2-2023]. Available at: https://www.upm.es/UPM/Biblioteca/ServiciosUsuario/Todos?id=88415ab81adc4510VgnVCM10000009c7648a____&fmt=detail&prefmt=articulo

[UPM, 2023b] Universidad Politécnica de Madrid: Normas de redacción y depósito de la tesis doctoral [retrieved 27-12-2023]. Available at: https://www.upm.es/Estudiantes/Estudios_Titulaciones/Estudios_Doctorado/Tesis/NormasRedaccionTesis

[UPM, 2023c] Universidad Politécnica de Madrid: THESIS, 2023 [retrieved 28-12-2023]. Available at: https://www.upm.es/thesis/

ANNEXES

This chapter is optional and shall be written based on thesis supervisor instructions to include documentation complementary to the thesis work.

It may contain a well-prepared and reasoned compilation of material that is not the focal point of the thesis, but that provides additional information to help to understand and specify part of the ideas that are developed in the thesis.

If you wish to include several appendices, they must go in different sections of this chapter, and they may also have a hierarchical structure divided into sections and subsections.

Annex A

Annex B