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Master of Science

## **A Very Long and Impressive Thesis Title with a Forced Line Break**

Dissertação para obtenção do Grau de Doutor em  
**Informática**

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 **FACULDADE DE  
CIÊNCIAS E TECNOLOGIA  
UNIVERSIDADE NOVA DE LISBOA**

<month>, <year>



## **A Very Long and Impressive Thesis Title with a Forced Line Break**

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*Dedicatory lorem ipsum.*



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# Agradecimientos

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The acknowledgements. You are free to write this section at your own will. However, usually it starts with the institutional acknowledgements (adviser, institution, grants, workmates, ...) and then comes the personal acknowledgements (friends, family, ...).





*«You cannot teach a man anything; you can only help him  
discover it in himself.» (Galileo)*



---

# Resumo

---

Independentemente da língua em que está escrita a dissertação, é necessário um resumo na língua do texto principal e um resumo noutra língua. Assume-se que as duas línguas em questão serão sempre o Português e o Inglês.

O *template* colocará automaticamente em primeiro lugar o resumo na língua do texto principal e depois o resumo na outra língua. Por exemplo, se a dissertação está escrita em Português, primeiro aparecerá o resumo em Português, depois em Inglês, seguido do texto principal em Português. Se a dissertação está escrita em Inglês, primeiro aparecerá o resumo em Inglês, depois em Português, seguido do texto principal em Inglês.

O resumo não deve exceder uma página e deve responder às seguintes questões:

- Qual é o problema?
- Porque é que ele é interessante?
- Qual é a solução?
- O que resulta (implicações) da solução?

E agora vamos fazer um teste com uma quebra de linha no hífen a ver se a  $\LaTeX$  duplica o hífen na linha seguinte...

zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz comentar-  
lhe zzz zzzz zzz zzzz

Sim! Funciona! :)

**Palavras-chave:** Palavra-chave 1, Palavra-chave 2, Palavra-chave 3, ...

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# Abstract

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The dissertation must contain two versions of the abstract, one in the same language as the main text, another in a different language. The package assumes that the two languages under consideration are always Portuguese and English.

The package will sort the abstracts in the appropriate order. This means that the first abstract will be in the same language as the main text, followed by the abstract in the other language, and then followed by the main text. For example, if the dissertation is written in Portuguese, first will come the summary in Portuguese and then in English, followed by the main text in Portuguese. If the dissertation is written in English, first will come the summary in English and then in Portuguese, followed by the main text in English.

The abstract should not exceed one page and should answer the following questions:

- What's the problem?
- Why is it interesting?
- What's the solution?
- What follows from the solution?

**Keywords:** Keyword 1, Keyword 2, Keyword 3, ...

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## Glossário

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# Siglas

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DI	Department of Computer Science and Informatics
FCT	NOVA School of Science and Technology
NOVA	NOVA University Lisbon
NOVAthesis	NOVAthesis LaTeX template
novathesis.cls	novathesis.cls class



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# Símbolos

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## Capítulo 1

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# Introduction

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### 1.1 The NOVAthesis template

The [NOVAthesis LaTeX template \(NOVAthesis\)](#) was initially directed to the PhD and MSc students thesis at [Department of Computer Science and Informatics \(DI\)](#) of the [NOVA School of Science and Technology \(FCT\)](#) of the [NOVA University Lisbon \(NOVA\)](#), Portugal, but currently (v5.1.5) it supports other degrees and Schools, namely:

- NOVA University Lisbon
  - NOVA School of Science and Technology ([FCT-NOVA](#))
  - NOVA Information Management School ([NOVA-IMS](#))
  - National School of Public Health ([ENSP-NOVA](#))
  - Faculdade de Ciências Humanas e Sociais ([FCSH-NOVA](#))
- University of Lisbon
  - Instituto Superior Técnico from Universidade de Lisboa ([IST-UL](#))
  - Faculdade de Ciências from Universidade de Lisboa ([FC-UL](#))
- Instituto Politécnico de Lisboa
  - Instituto Superior de Engenharia de Lisboa ([ISEL-IPL](#))
- Instituto Politécnico de Setúbal
  - Escola Superior de Saúde ([ESS-IPS](#))
  - Escola Superior de Tecnologia do Barreiro ([ESTB-IPS](#))

- Escola Superior de Enfermagem do Porto ([ESEP](#))

The template provides an *easy to use* setting for you to write your thesis/dissertation in  $\text{\LaTeX}$ :

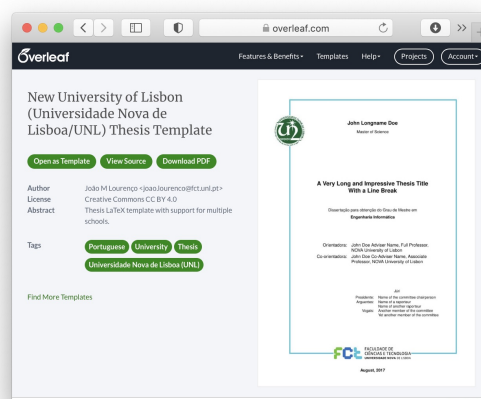
- Select your school;
- Fill your thesis metadata (title, research field, etc) in the file “`template.tex`”;
- Create your thesis/dissertation contents using the files in folder “`Chapters`”; and
- Process using you favorite  $\text{\LaTeX}$  processor ( $\text{pdf\LaTeX}$ ,  $\text{Xe\LaTeX}$  or  $\text{Lua\LaTeX}$ ).

## 1.2 Getting Started

### 1.2.1 Using Overleaf

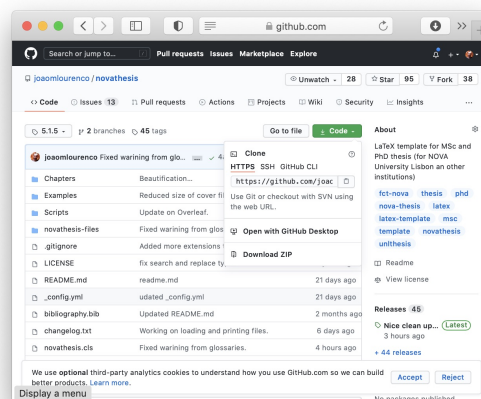
Just access the [NOVathesis LaTeX template](#) in [Overleaf](#) and select the green button *Open as Template*.

Please note that the version currently available in Overleaf (v4.1.3) is outdated. A new version will be submitted to Overleaf soon.



### 1.2.2 Using a Local $\text{\LaTeX}$ Installation

Just access the [NOVathesis LaTeX template](#) in [GitHub](#), select the green button *Code* and then *download* (or *clone*) the template. You will always get the latest version of the template (currently v5.1.5).



## 1.3 Getting Help

Please do not send me emails! I will not answer them!

### 1.3.1 Google

Remember, when looking for hints or help, *Google is your best friend!* And if you prefix your Google query with “*LaTeX*”, your first link will most probably direct you to [tex.stackexchange.com](https://tex.stackexchange.com).

### 1.3.2 Group Support

To get directed help on the [NOVAthesis LaTeX template](#) please join:

- the [NOVAthesis Facebook group](#), or
- the [NOVAthesis Google group](#).

There were huge changes from version 4.x.y to version 5.a.b so, please, **always** state the version number you are using when asking for help.

### 1.3.3 Reporting Problems

If you just need some help, see above Sections [1.3.1](#) and [1.3.2](#).

If you believe *you found a bug* or if *you need some improvement* in the template, please [fill an issue in github](#) at <https://github.com/joaomlourengo/novathesis/issues>.

## 1.4 Donations

This template is the result of hundreds (yes! *may hundreds!*) of hours of work from the [main developer](#). If you think this template really made your life easier while writing your thesis, please consider [making a donation](#). We will keep a list thanking to all the identified donors that identify themselves in the “*Add special instructions to the seller*” box.

### Donnors 2020

João Carvalho, David Romão, DisplayersereStream, and António Estêvão.

### Donnors 2019

Jorge Barreto and Raissa Almeida.

## 1.5 Disclaimer

Although this template is endorsed by the FCT-NOVA and even [linked from its web site](#), this is still not an official template. This template exists to make your life easier and we do our best to make the [NOVAthesis](#) template compliant to the supported Schools’ regulations, but in the end of the line you and only you are accountable for both the look and the contents of the document you submit as your thesis/dissertation.





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# ThesisDIFCTNL *User's Manual*

---

## 2.1 Introduction

This chapter describes how to use the [NOVAthesis LaTeX template \(NOVAthesis\)](#) and the [novathesis.cls class \(novathesis.cls\)](#) file.

Let's start with some simple suggestions: [6, 10].



---

# A Short $\text{\LaTeX}$ Tutorial with Examples

---

This Chapter aims at exemplifying how to do common stuff with  $\text{\LaTeX}$ . We also show some stuff which is not that common! ;)

Please, use these examples as a starting point, but you should always consider using the *Big Oracle* (aka, [Google](#), your best friend) to search for additional information or al-ternative ways for achieving similar results.

## 3.1 Document Structure

## 3.2 Dealing with Bibliogrpahy

## 3.3 Inserting Tables

## 3.4 Importing Images

## 3.5 Floats, Figures and Captions

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet,

tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

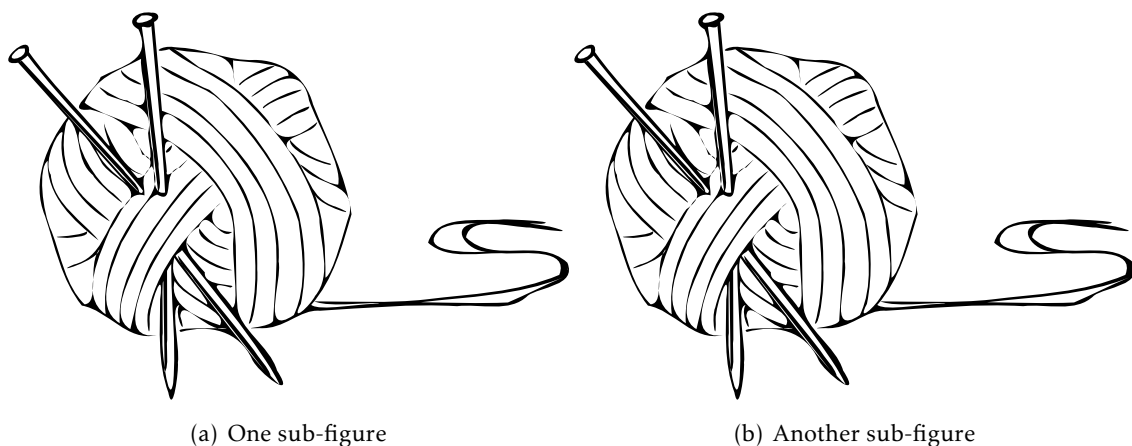


Figura 3.1: A figure with two sub-figures!

And this is a small text that references the Figure 3.1 and its Subfigures 3.1(a) and 3.1(b).

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem

non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

## 3.6 Text Formatting

## 3.7 Generating PDFs from L<sup>A</sup>T<sub>E</sub>X

### 3.7.1 Generating PDFs with pdf<sub>l</sub>atex

You may create PDF files either by using `latex` to generate a DVI file, and then use one of the many DVI-2-PDF converters, such as `dvipdfm`.

Alternatively, you may use `pdflatex`, which will immediately generate a PDF with no intermediate DVI or PS files. In some systems, such as Apple, PDF is already the default format for L<sup>A</sup>T<sub>E</sub>X. I strongly recommend you to use this approach, unless you have a very good argument to go for `latex + dvipdfm`.

A typical pass for a document with figures, cross-references and a bibliography would be:

```
$ pdflatex template
$ bibtex template
$ pdflatex template
$ pdflatex template
```

You will notice that there is a new PDF file in the working directory called `template.pdf`. Simple :)

Please note that, to be sure all table of contents, cross-references and bibliographic citations are up-to-date, you must run `latex` once, then `bibtex`, and then `latex` twice.

### 3.7.2 Dealing with Images

You may process the same source files with both `latex` or `pdflatex`. But, if your text include images, you must be careful. `latex` and `pdflatex` accept images in different (exclusive) formats. For `latex` you may use EPS ou PS figures. For `pdflatex` you may use JPG, PNG or PDF figures. I strongly recommend you to use PDF figures in vectorial format (do not use bitmap images unless you have no other choice).

### 3.7.3 Creating Source Files Compatible with both `latex` and `pdflatex`

Do not include the extension of the file in the `\includegraphics` command. E.g., use

```
\includegraphics{sonwman}
```

and not

```
\includegraphics{sonwman.eps}.
```

If you use the first form, `latex` or `pdflatex` will add an appropriate file extension.

This means that, if you plan to use only `pdflatex`, you need only to keep (preferably) a PDF version of all the images. If you plan to use also `latex`, then you also need an EPS version of each image.

## To be included in the sections above

Para fazer citações, deverá usar-se a chave da referência no ficheiro BibTeX. Se for uma única referência [2], usar um “~” para ligar o `\cite{...}` à palavra que o precede (...referência~\cite{Artho04}). Caso queira fazer múltiplas citações [7, 8, 6], deverá agrupá-las dentro de um único `\cite{...}`.

Note que o ficheiro de bibliografia pode ter tantas entradas quantas quiser. Apenas aquelas cuja chave seja referenciada no texto é que serão incluídas na listagem de bibliografia.

Footnotes<sup>1</sup> will be numbered and shown in the bottom of the page.

A Tabela 3.1 ilustra alguns conceitos importantes associados à construção de tabelas:

- i) Não usar linhas verticais;
- ii) A legenda deve ficar por cima da tabela;
- iii) Usar as macros `\toprule`, `\midrule` e `\bottomrule` para fazer a linha horizontal superior, interiores e inferior, respectivamente.

Tabela 3.1: Test results summary.

Test	Anomalies	Warnings	Correct	Categories	Missed
[3] Connection	2	2	1	C	1
[1] Coordinates’03	1	4	1	2B, 1C	0
[1] Local Variable	1	2	1	A	0
[1] NASA	1	1	1	—	0
[2] Coordinates’04	1	4	1	3C	0
[2] Buffer	0	7	0	2A, 1B, 2C, 2D	0
[2] Double-Check	0	2	0	1A, 1B	0
[4] StringBuffer	1	0	0	—	1
[9] Account	1	1	1	—	0
[9] Jigsaw	1	2	1	C	0
[9] Over-reporting	0	2	0	1A, 1C	0
[9] Under-reporting	1	1	1	—	0
[5] Allocate Vector	1	2	1	C	0
Knight Moves	1	3	1	2B	0
<b>Total</b>	<b>12</b>	<b>33</b>	<b>10</b>	<b>5A, 6B, 10C, 2D</b>	<b>2</b>

As figuras a inserir no documento deverão ser de qualidade, preferencialmente em formato vectorial (PDF vectorial) e não em *bitmap* (PNG, JPG, etc). As imagens *bitmap* (Figura 3.2) não escalam bem e têm reflexos negativos na qualidade do seu documento. Pelo contrário, as imagens *vectoriais* Figura 3.3 escalam muito tanto quanto o necessário sem degradar a qualidade da imagem.

Só deve usar *screenshots* se não tive mesmo nenhuma alternativa. Em vez de gerar um *screenshot*, tente usar uma impressora virtual PDF e imprimir para um ficheiro PDF. Regra

<sup>1</sup>This is a simple footnote.

geral obterá um PDF vetorial. Mesmo que o seu PDF contenha imagens, elas terão sempre qualidade maior ou igual à que obteria com um *screenshot*.

Para agregar várias figuras numa única... Poderá assim referenciar o conjunto 3.4, a primeira delas 3.4() ou a segunda 3.4(a).

Para incluir listagens de código no seu documento, deverá incluir o pacote *listings* e depois usar o ambiente *lstlisting*, como exemplificado na Listagem 3.1.

Listagem 3.1: Hello World

```
1  /**
2   * The HelloWorldApp class implements an application that
3   * simply prints "Hello World!" to standard output.
4   */
5  class HelloWorldApp {%
6      public static void main(String[] args) {%
7          System.out.println("Hello World!"); // Display the string.
8      }
9  }
```

## 3.8 Equações

O LaTeX é uma ferramenta poderosa para escrever em estilo matemático. Permite inserir fórmulas no meio do texto como por exemplo esta:  $ax^2 + bx + c = 0$ . Também permite que as fórmulas sejam destacadas numa linha separada e centradas na página

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

ou numeradas

$$aaa \tag{3.1}$$

que depois pode ser referida no texto como sendo a equação 3.1

$$aa$$

$$a \tag{3.2}$$

$$b \tag{3.3}$$

$$c \tag{3.4}$$

$$\tag{3.5}$$

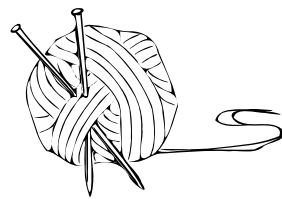




Figura 3.2: Imagem em formato *bitmap* (JPG)



Figura 3.3: Imagem em formato PDF vectorial



(a) Novelo de lã



(b) Tempestade com neve

Figura 3.4: Exemplo de utilização de *subbottom*



---

## Bibliografia

---

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## Appendix 1 Lorem Ipsum

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## Appendix 2 Lorem Ipsum

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