LaTeX – The basics*

José Oliveira Fernando Costa

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Abstract

This is a basic tutorial to make people start using LaTeX and use the template for IEMS'13 submission.

1 The software

To run LaTeX in windows you need MiKTeX and TeXMaker. The later is a text editor while the former is the compiler. To see how to proceed check sections 1.1 and 1.2.

1.1 How to install MikTeX

Easy: accept... next... next... next... done!

1.2 How to install TEXMaker

Also easy: accept... next... next... next... done!

2 Special characters

2.1 Spaces

In LaTeX it does not matter whether you enter one or several spaces after a word. They will be all merged in a single space. Changing line is equivalent to a space.

To start a new paragraph you have to insert an empty line.

2.2 Some characters are special

The following symbols are reserved characters that have a special meaning under LaTeX:

```
# $ % ^ & _ { } ~ \
```

But they can be "written" and printed if adding a prefix backslash:
$ % & _ { } \~{} \

Note: two backslash characters mean "new line"
(but not new paragraph).

We will see later the meaning and use of the special characters. But right now, we can learn that % makes all the remaining text of that line become a comment.

*Presented in DEGI Club

3 Formatting

Sometimes we need to call the attention for parts of our text or show that those parts are different. For that purpose we have the LaTeX commands **bold**, *italic* and *emphasise*.

4 Lists and bullets

It is common to organize our information in lists, either with bullets:

- first item
- second item
- third item

or numbered:

1. first item
2. second item
3. third item

or even mixed:

1. first item
2. second item
    - first item
    - second item
    - third item
3. third item

5 How to write mathematics

To write mathematics in LaTeX you have to enter in math mode. You can do that in line, by using the special character $ to open and close the math mode, or have equations in a separate line, by using the environments *displaymath* or *equation*. The difference is that *equation* numbers the equations and *displaymath* not.

Let us see an example:

$$\sum_{i=1}^{n} \frac{\pi^2}{\sqrt{x_{jkl}-1}} \leq 1 \tag{1}$$

This same expression, when in line, is displayed slightly differently: $\sum_{i=1}^{n} \frac{\pi^2}{\sqrt{x_{jkl}-1}} \leq 1$, as you can see.

6 Tables and figures

There is no good scientific work without a few tables and figures. It is important to differentiate between the tabular or pictorial information itself, from the table or figure as an entity that has also a sequential number, a caption, a label to be referred to and can be placed where is more convenient (or typographically correct): LaTeX decides where this material should go, according to well established typographic rules.

6.1 The tabular environment

To organize information in a table, LaTeX uses the tabular environment:

```
\begin{tabular}{lcccr}
  &  Porto & Lisbon & Algarve & Total \\
Product 1 & 120 & 234 & 435 & 789 \\
Product 2 & 220 & 250 & 234 & 704 \\
Product 3 & 100 & 456 & 354 & 910 \\
Product 4 & 130 & 544 & 284 & 958
\end{tabular}
```

	Porto	Lisbon	Algarve	Total
Product 1	120	234	435	789
Product 2	220	250	234	704
Product 3	100	456	354	910
Product 4	130	544	284	958

It may useful to have horizontal and vertical lines separating data form headings:

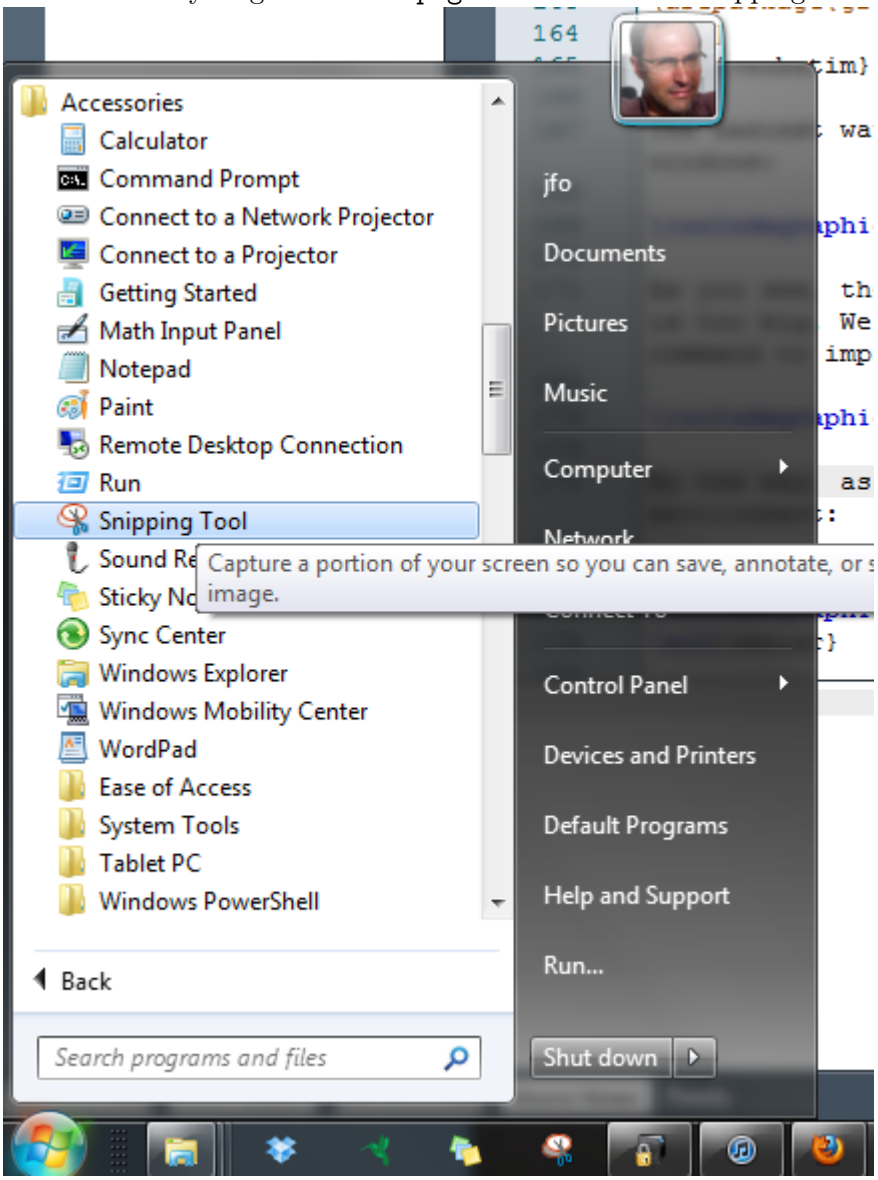
	Porto	Lisbon	Algarve	Total
Product 1	120	234	435	789
Product 2	220	250	234	704
Product 3	100	456	354	910
Product 4	130	544	284	958

6.2 Inserting figures

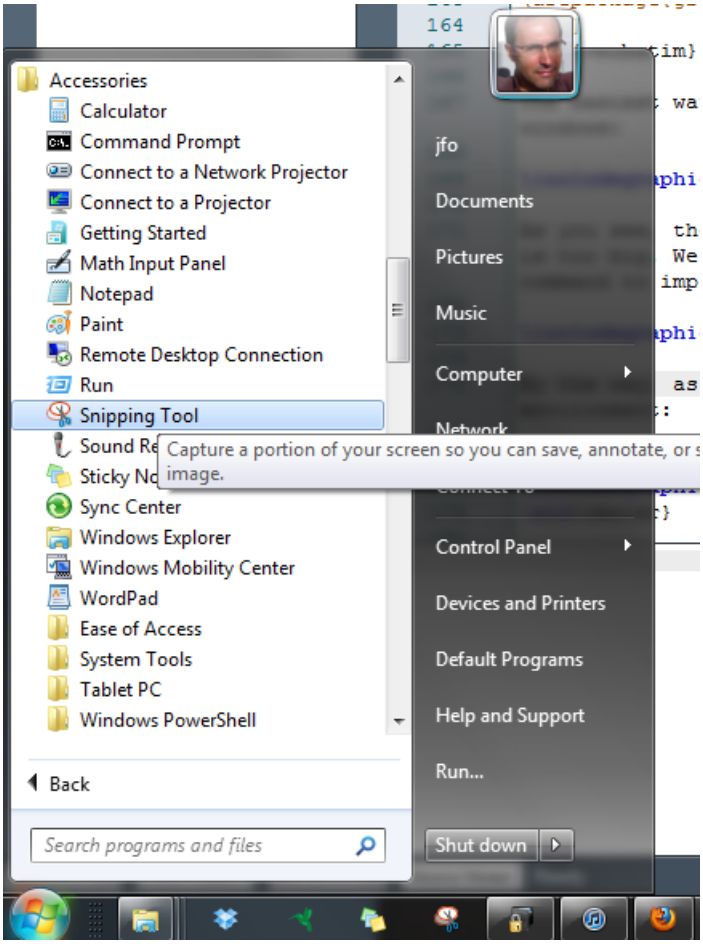
Figures are inserted by the `\includegraphics{filename}` command. So, you need a file with your graphics. LaTeX supports a lot of image formats but we will focus on the simplest one: the `png` format. The disadvantage of`png` is that it is a raster format, not scalable. Therefore, whenever you have your picture in the `pdf` format you should use it instead, but pdf generation is out of the scope of this tutorial. Finally, to use the `\includegraphics{filename}` command you need to include the package `\includegraphics{filename}` in the preamble:

```
\documentclass[a4paper,11pt]{article}

\usepackage[portuges,english]{babel}
\usepackage[utf8]{inputenc}
\selectlanguage{english}

\usepackage{graphicx}
[...]
```

The easiest way to generate the `png` file is to use the "snipping tool" in windows:



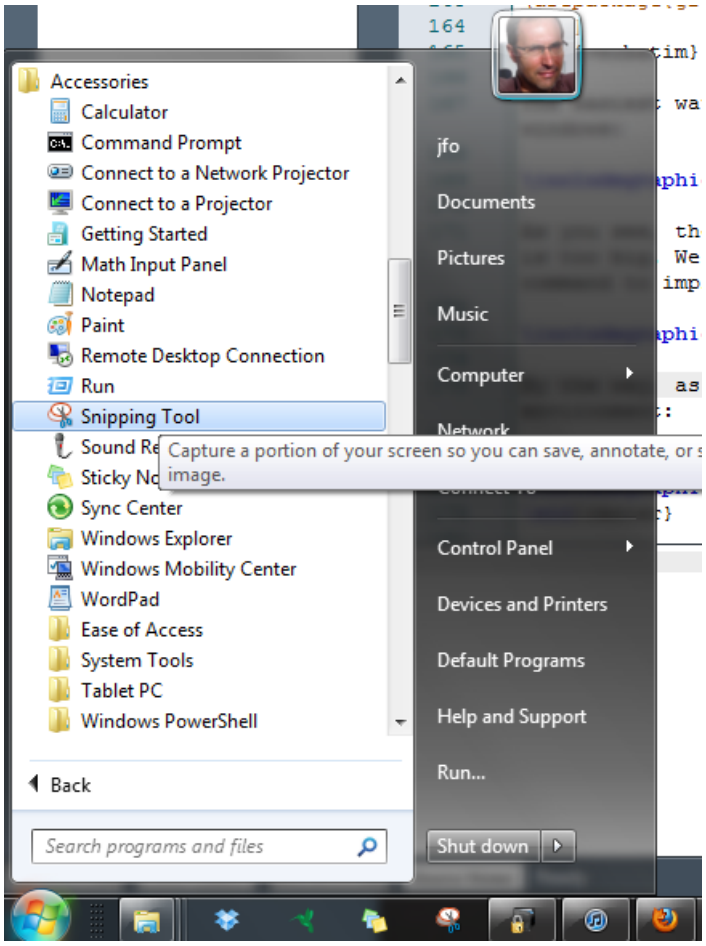
As you see, there are problems with the picture resolution but it also true that the size is too big. We can use option `scale` from the `\includegraphics{filename}` command to improve that:



By the way, as we like figures centered, it is the moment to use the `center` environment:

Table 1: This is an example of a table.

	Porto	Lisbon	Algarve	Total
Product 1	120	234	435	789
Product 2	220	250	234	704
Product 3	100	456	354	910
Product 4	130	544	284	958



6.3 The table and figure float environments

Table and figure environments are exactly the same, except that they have separate counters and therefore they are separately numbered. Other differences that exist in their use come from typographical rules (i.e. figure captions are always bellow the figures, while table captions are always above the tables).

In table 1 and figure 1 we have two examples of the use of the `table` and `figure` environments. Notice that table 1, as it is a floating environment, was placed at the top of the page, before the picture previously statically placed, and figure 1, another floating environment, appears in the next page.

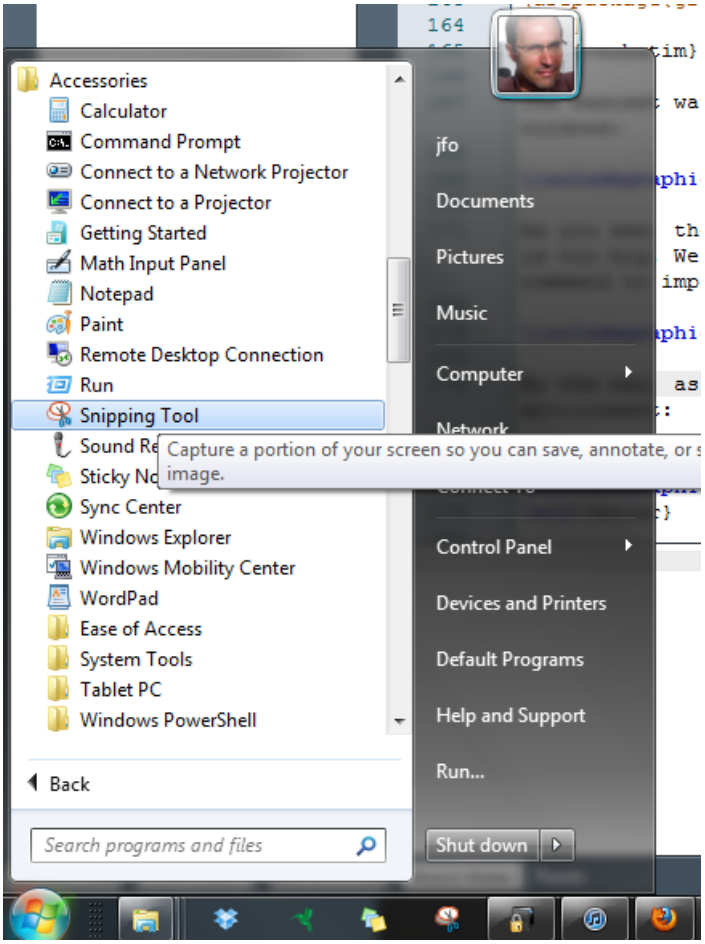


Figure 1: This is an example of a figure.

7 Bibliography and citations

A final word about bibliographies and citations. Once again we will go through the most basic and "vanilla flavour" way of making bibliographies and citations.

To declare the list of references that you want to cite along the text, LaTeX provides a special environment: `thebibliography`. As this environment also produces the list itself, it usually goes to the very end of the document, just before the `\end{document}`.

Now we can see that [Bennell and Oliveira, 2008] claims something while in [Carravilla and Ribeiro, 2005] the opposite is supported. After adding a new reference to the list you have to run `PDFLaTeX` twice, in order to have that reference recognised for citation purposes.

We can also change the way how the references are displayed by changing each `\bibitem` option, for instance to a number.

8 Further support

If you have a problem using LaTeX, something that you would like to do and you don't know how, the chances are that someone before you had the same problem or desire and the solution exists. Google is our friend and a precise question always returns a precise answer. Nevertheless, some sites have particularly importante information.

The first one is the wikibook of LaTeX:

`http://en.wikibooks.org/wiki/LaTeX`

You can find other LaTeX tutorials (not so good as this one, of course) here:

`http://mrskrummel.com/tutorials` (this includes a video tutorial)
`http://www.andy-roberts.net/writing/latex`

A Latex cheat sheet is available here:

`http://www.stdout.org/ winston/latex/`

References

[Bennell and Oliveira, 2008] Bennell, J. A. and Oliveira, J. F. (2008). The geometry of nesting problems: a tutorial. *European Journal of Operational Research*, 184(2):397–415.

[Bennell and Oliveira, 2009] Bennell, J. A. and Oliveira, J. F. (2009). A tutorial in irregular shape packing problems. *Journal of the Operational Research Society*, 60:S93–S105.

[Carravilla and Ribeiro, 2005] Carravilla, M. A. and Ribeiro, C. (2005). CP and MIP in the resolution of hard combinatorial problems: a case study with nesting problems. In *CSCLP 2005 Joint ERCIM/CoLogNET International Workshop on Constraint Solving and Constraint Logic Programming*:113–127.

[Carravilla et al., 2003] Carravilla, M. A., Ribeiro, C., and Oliveira, J. F. (2003). Solving nesting problems with non-convex polygons by constraint logic programming. *International Transactions in Operational Research*, 10(6):651–663.