LaTeX Workshop

a bio* event

by *Ricardo Sousa*

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http://biostar.fe.up.pt **biostar@fe.up.pt**

Post-graduate students ⟷ **R&D** ⟷ **Undergraduate students**

bio-metrics
bio-imaging
bio-robotics
bio-informatics
…

Past Workshops:

- Introduction to Matlab
- Image Processing using MatLAB
- Introduction to C/C++

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Outline.

Outline.

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What is LaTeX?

- LaTeX is a typesetting system;
- Allows the production of scientific (and non-scientific) documents;
- High-quality results.

*Check references of this presentation for further information.

LaTeX in a nutshell.

Save following lines in a file named: minimal.tex

```
\documentclass{article}
\begin{document}
Small is beautiful.
\end{document}
```

and then, on the command line (run twice at least):

```
$ pdflatex minimal
...
$ pdflatex minimal
```

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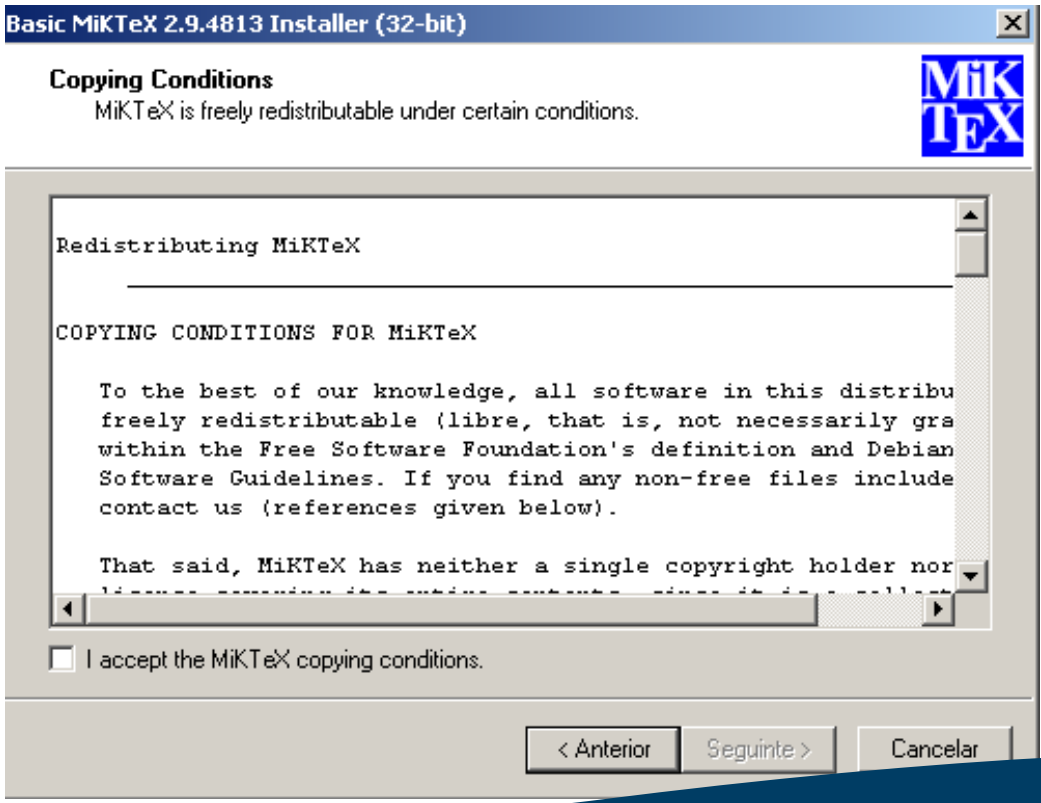
Outline.

Installing LaTeX.

Figure : MiKTeX homepage.

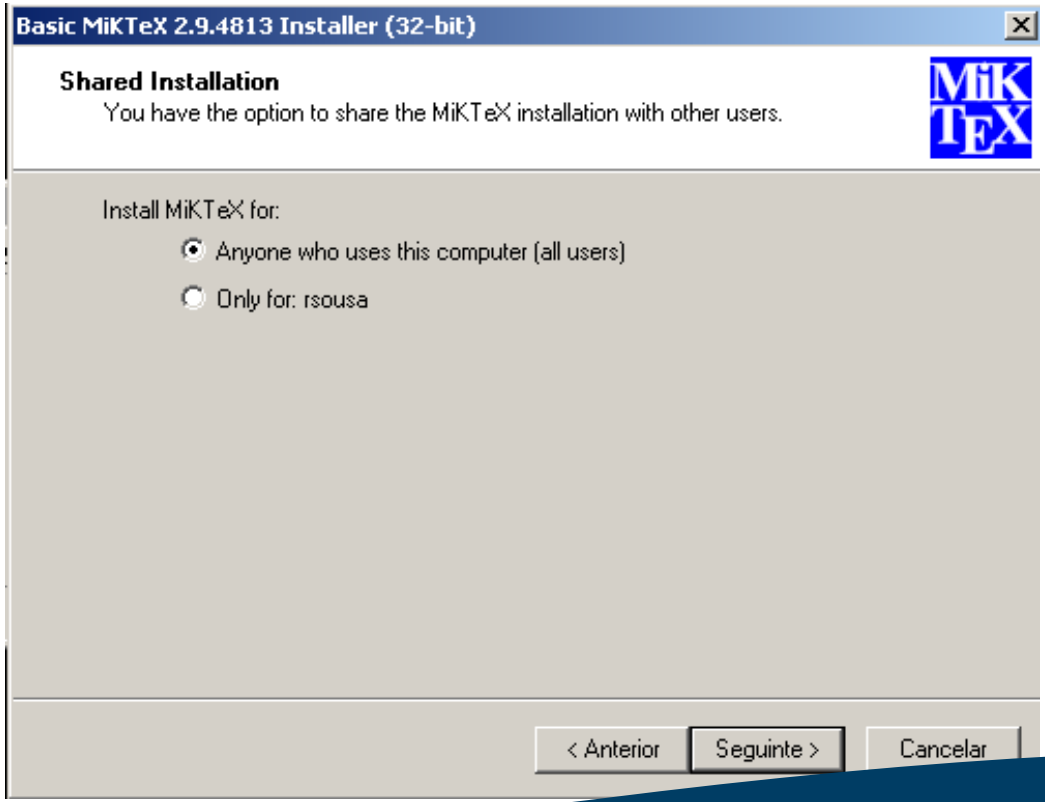
Installing LaTeX.

Figure : MiKTeX conditions.



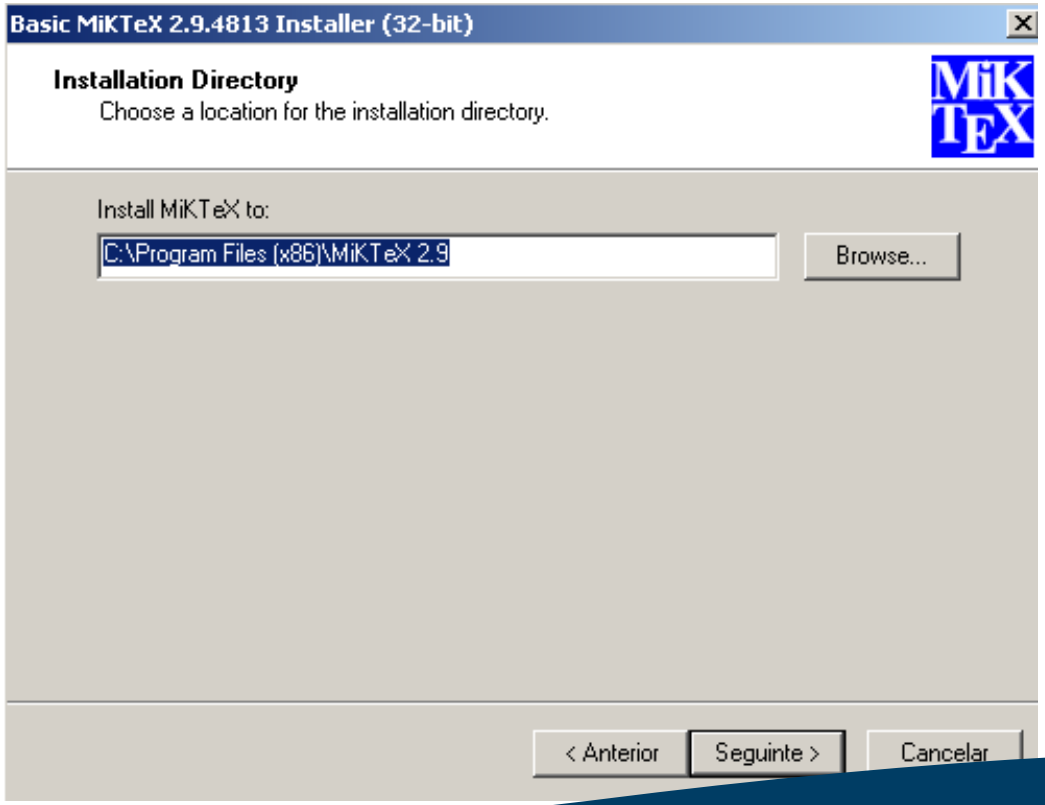
Installing LaTeX.

Figure : Standard configuration access profile.



Installing LaTeX.

Figure : Installation directory.



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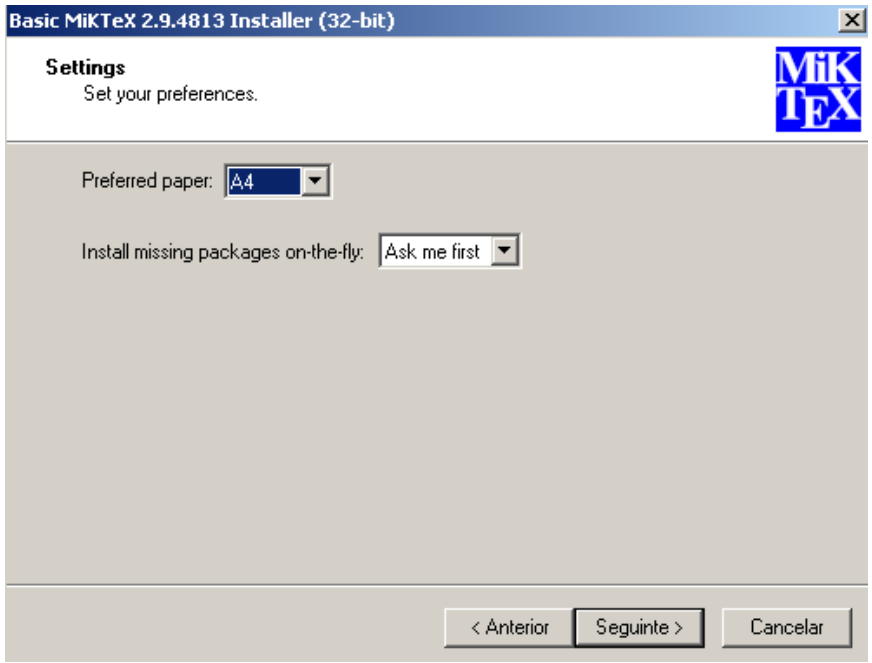
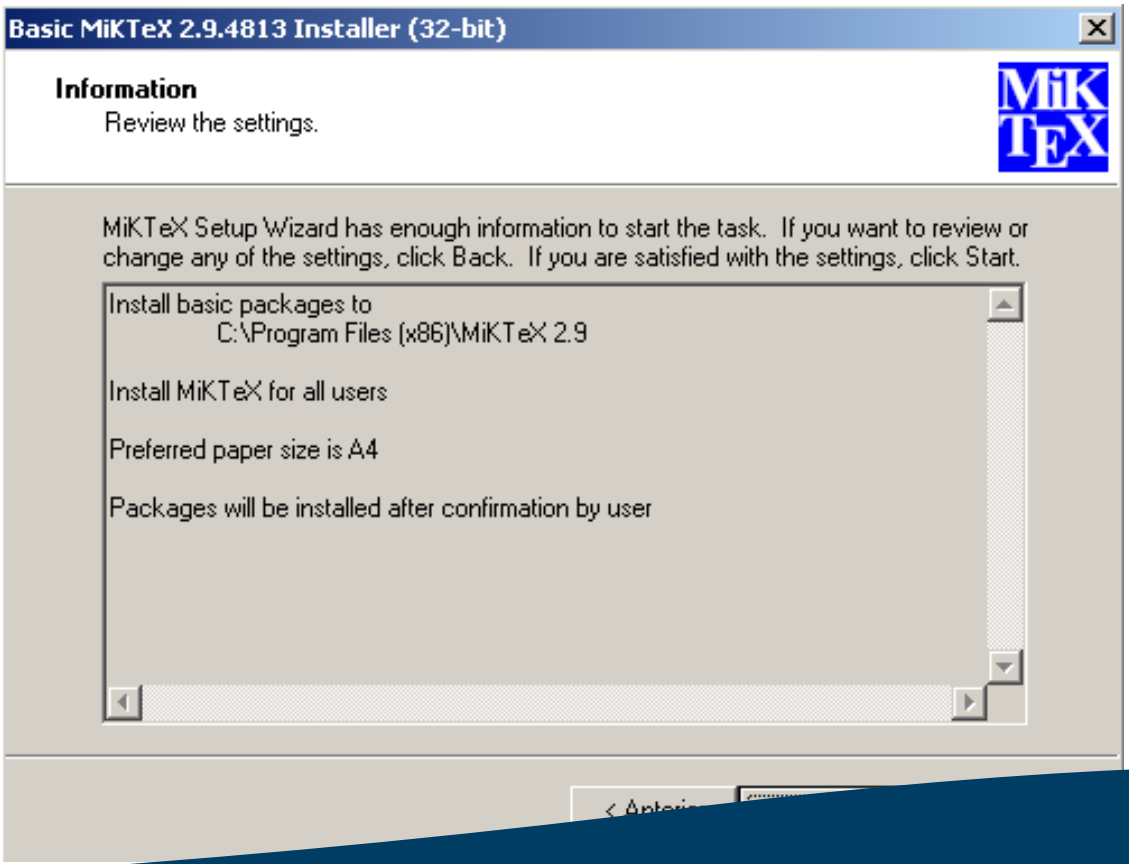
Installing LaTeX.

Figure : Some customizations (can be changed afterwards).



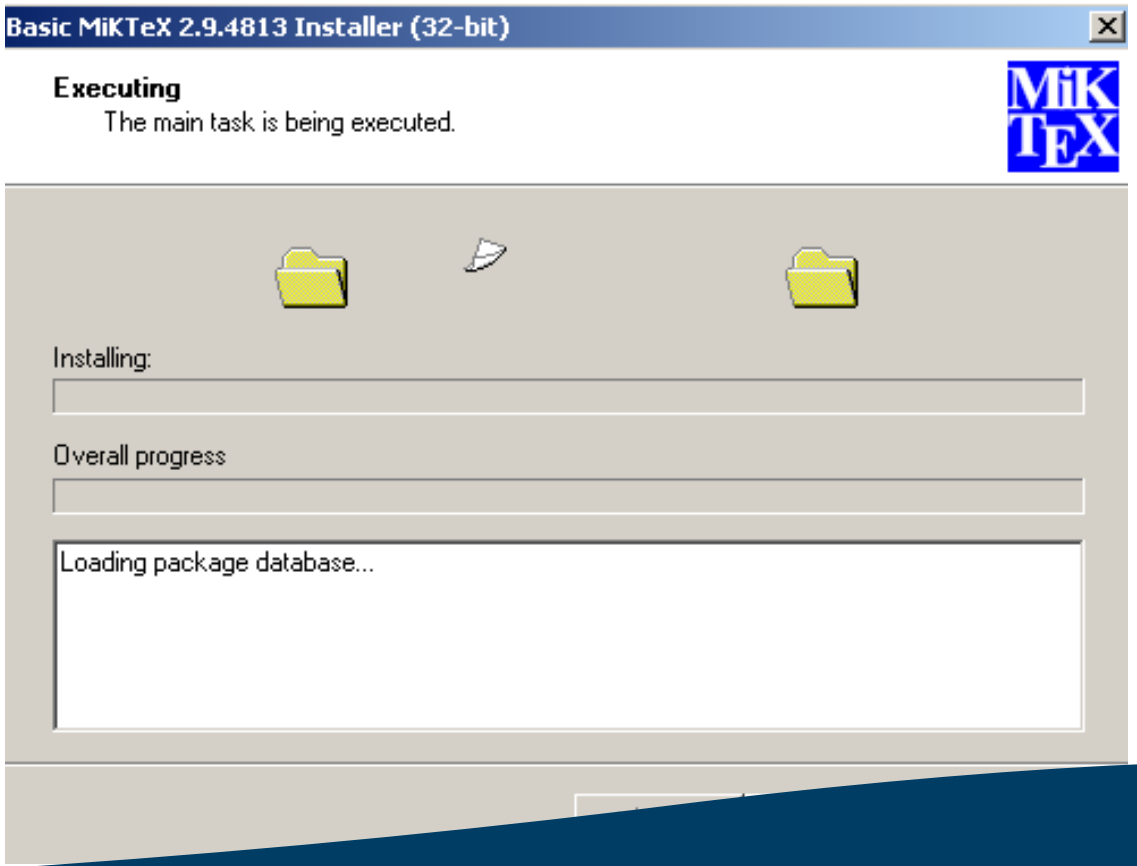
Installing LaTeX.

Figure : Review installation settings.



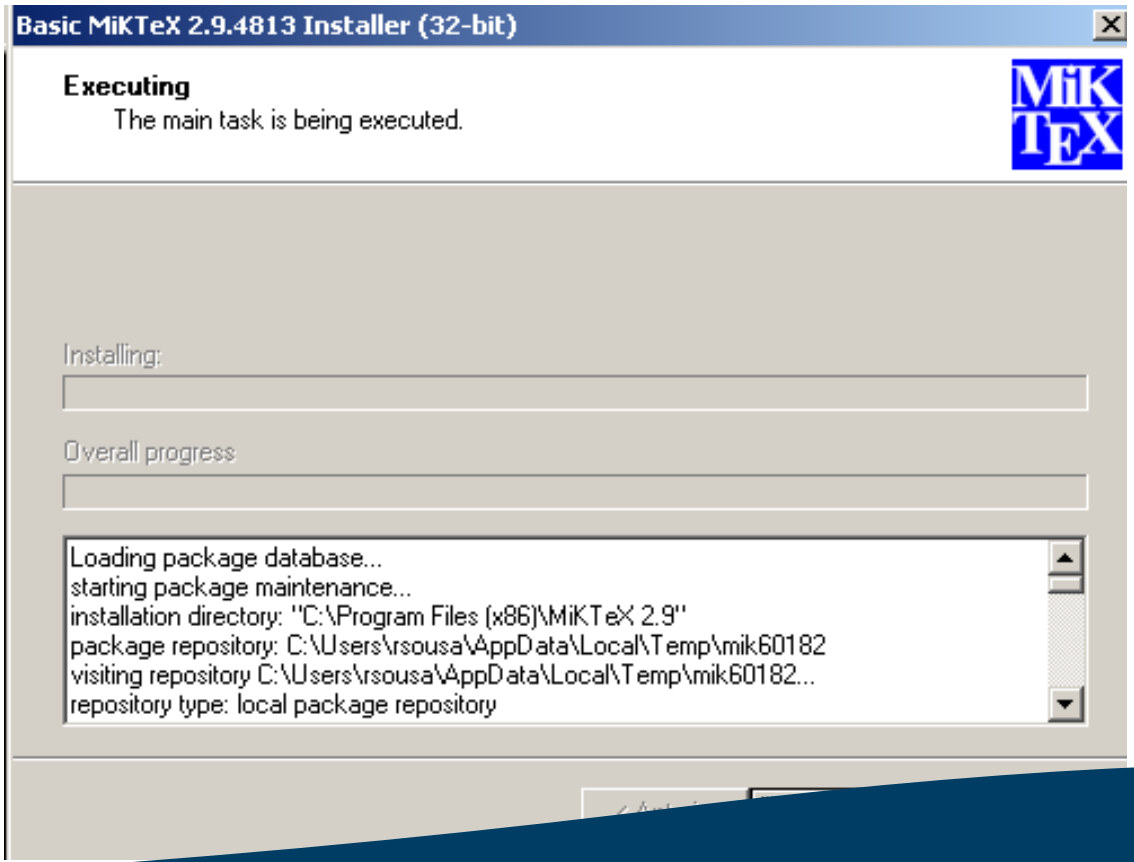
Installing LaTeX.

Figure : Installation (this may take a while).



Installing LaTeX.

Figure : Installation (finished).



Installing LaTeX.

Figure : Installation finished.

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Installing MiKTeX Portable.

Figure : MiKTeX Portable Homepage.

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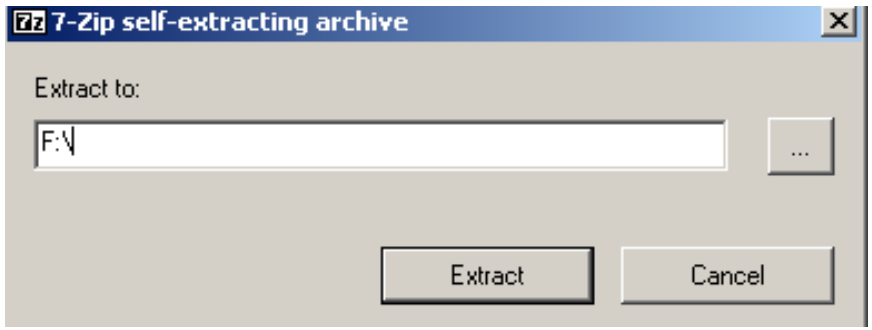
Installing MiKTeX Portable.

Figure : Extract to a given directory (e.g., pen drive).



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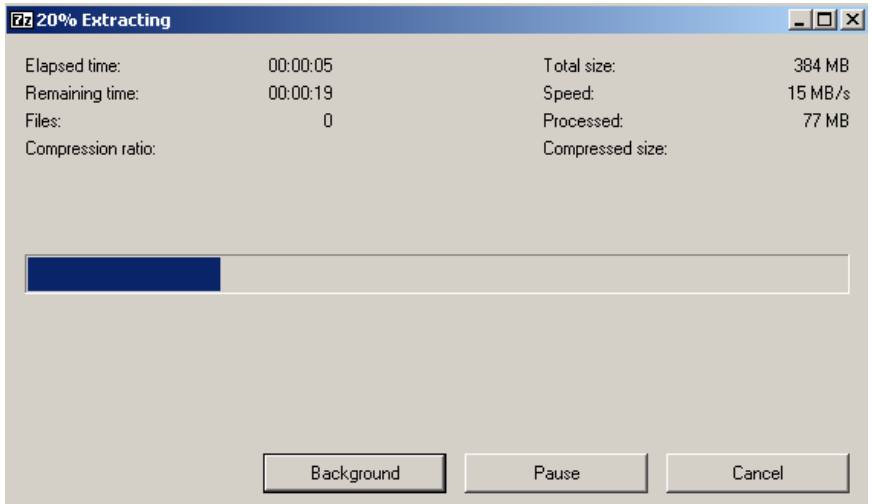
Installing MiKTeX Portable.

Figure : Extraction (this may take a while).



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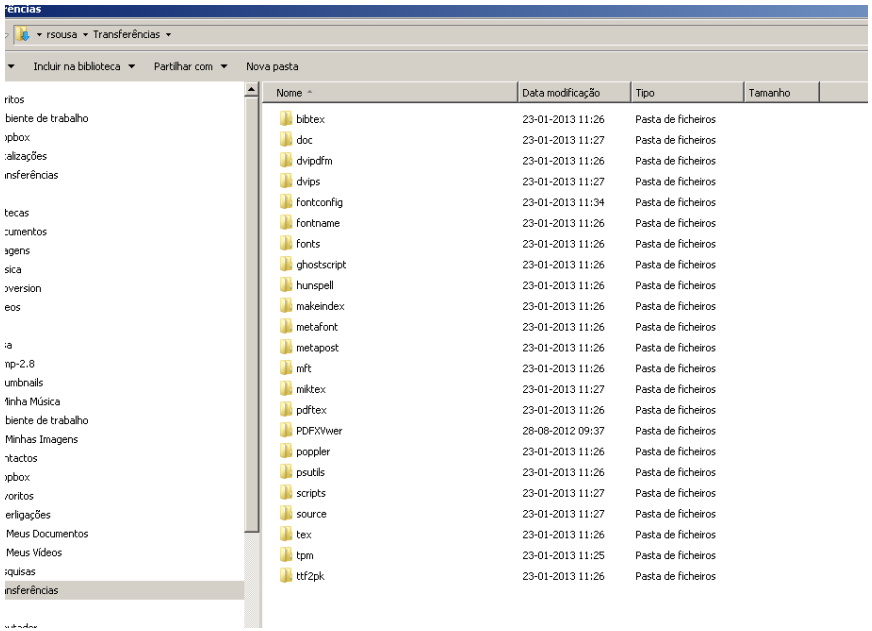
Installing MiKTeX Portable.

Figure : MiKTeX.



Outline.

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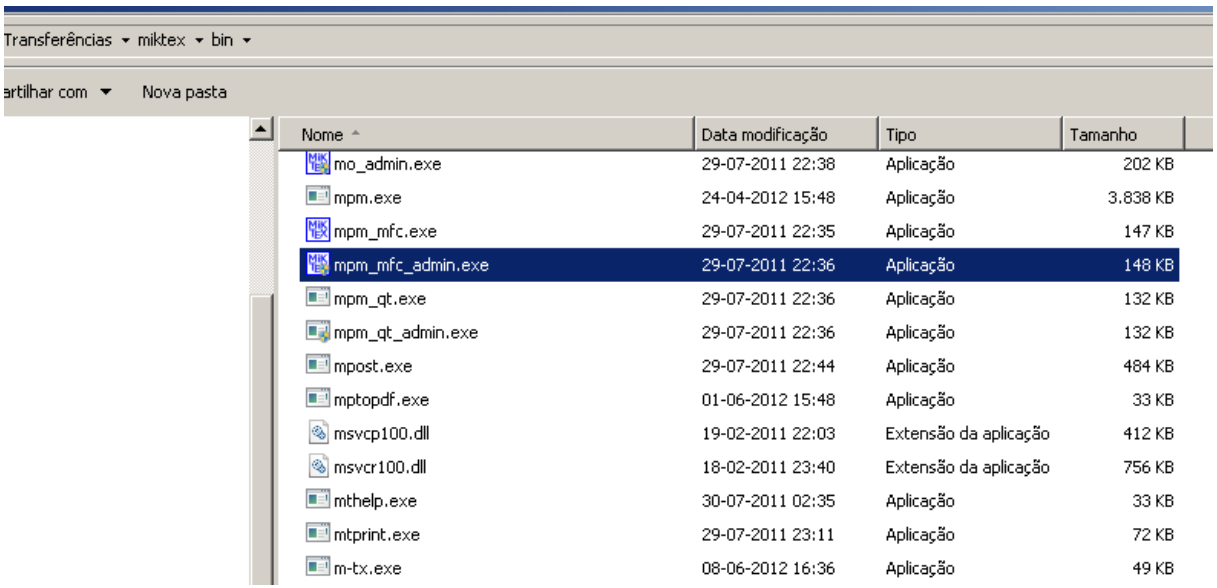
Maintaining LaTeX Updated - Part I.

Figure : Maintaining LaTeX (MiKTeX Portable).



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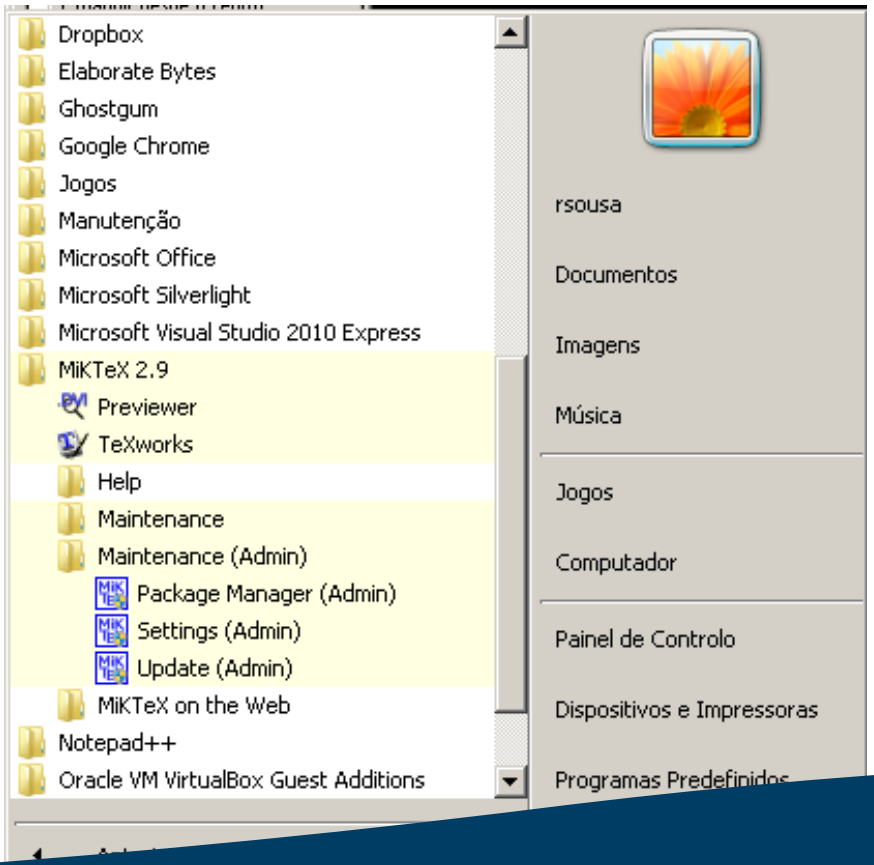
Maintaining LaTeX Updated - Part I.

Figure : MiKTeX maintenance options (select update).



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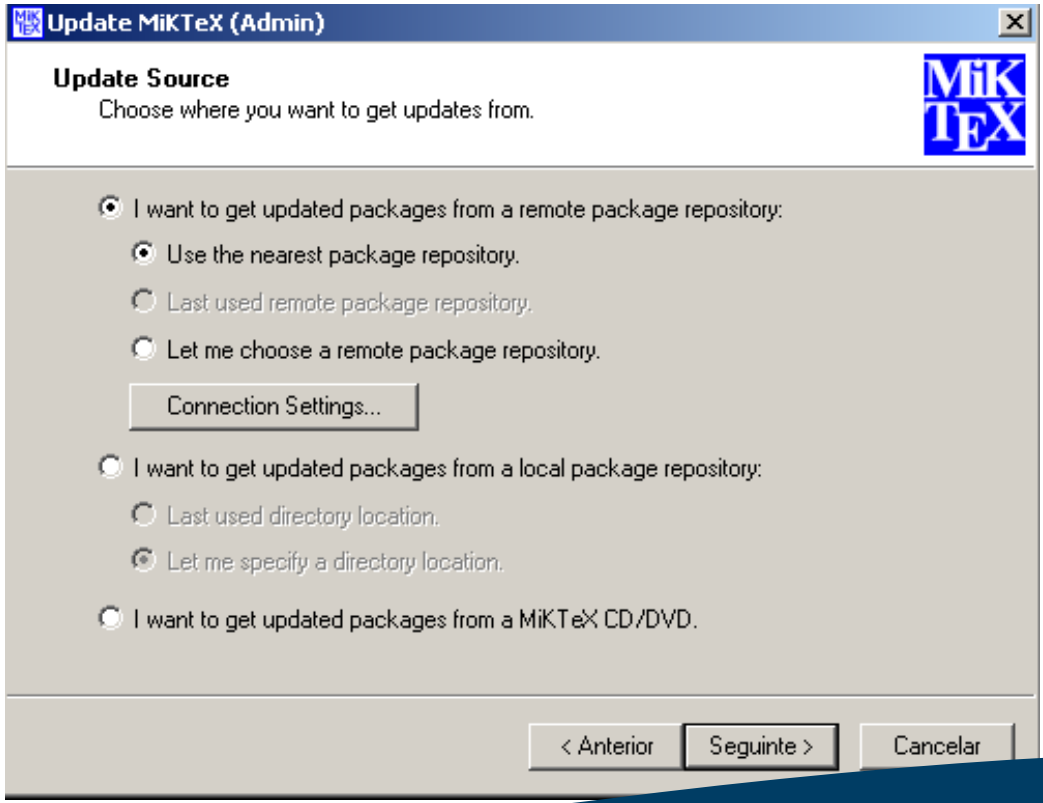
Maintaining LaTeX Updated - Part I.

Figure : Select updates sources.



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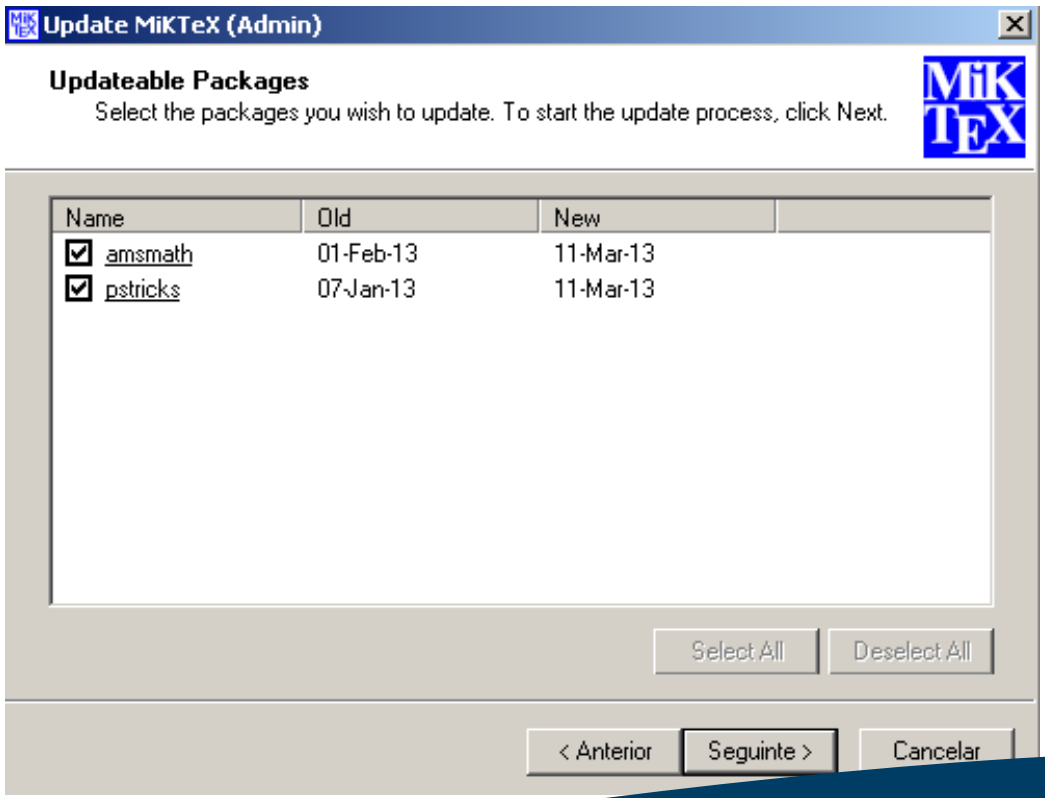
Maintaining LaTeX Updated - Part I.

Figure : Example of packages to be updated.



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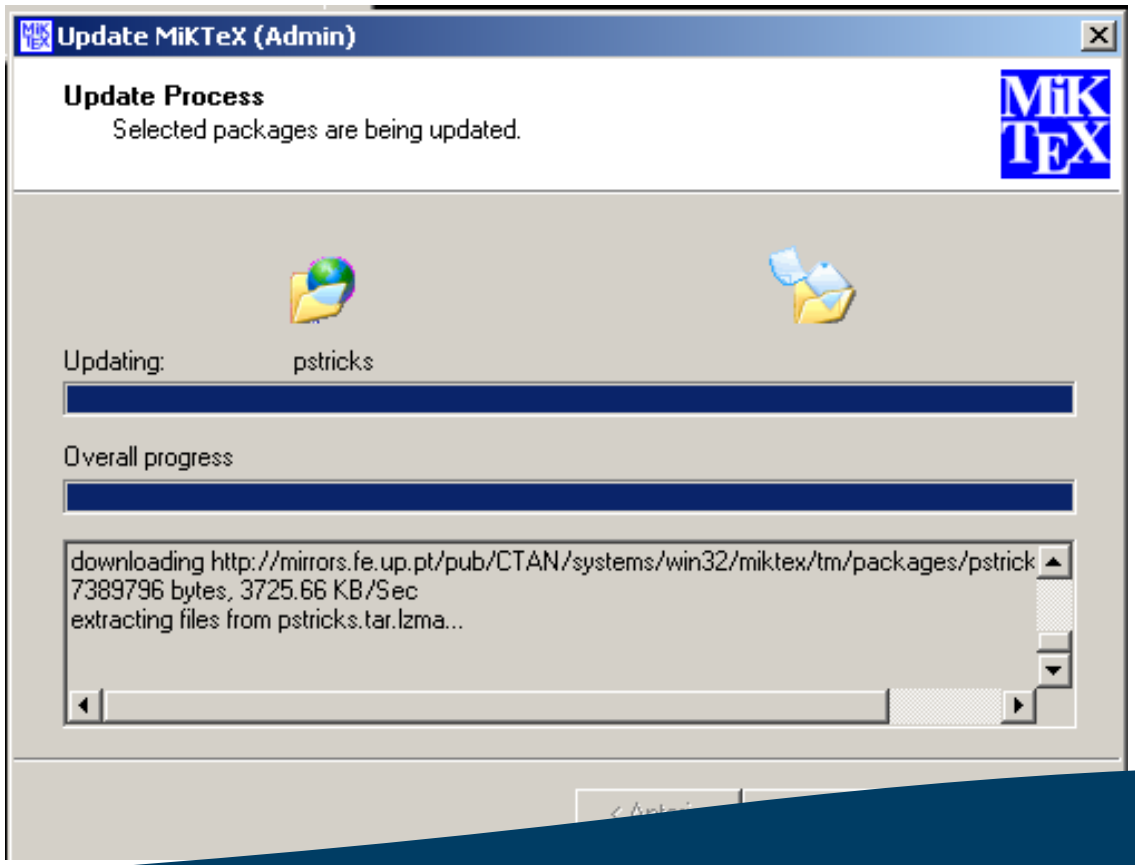
Maintaining LaTeX Updated - Part I.

Figure : Update ongoing.



Maintaining LaTeX Updated - Part I.

Figure : Update conclusion.

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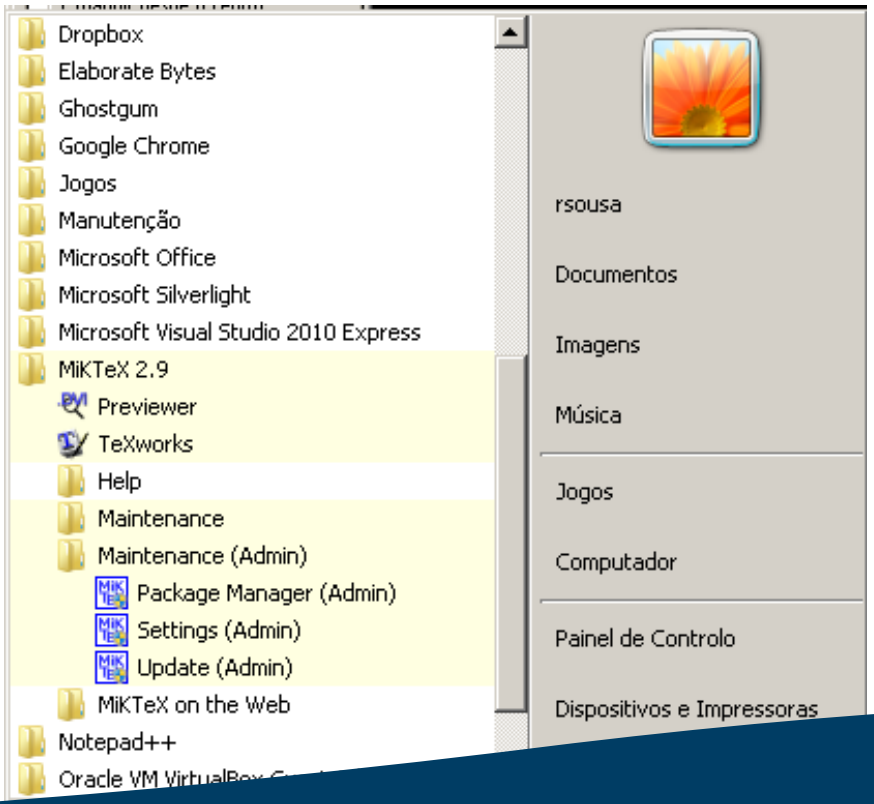
Maintaining LaTeX Updated - Part II.

Figure : MiKTeX maintenance options (select package manager).



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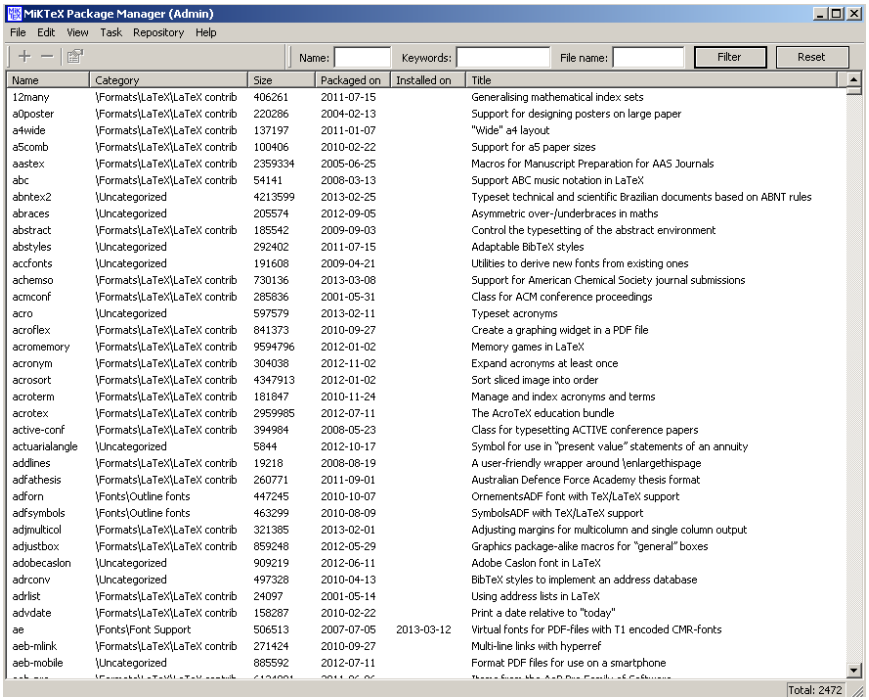
Maintaining LaTeX Updated - Part II.

Figure : Packages listing.



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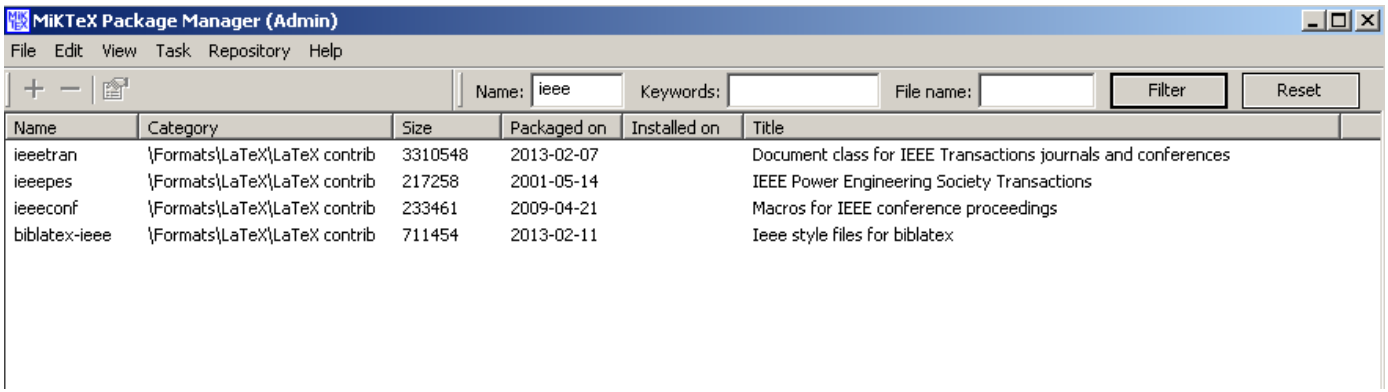
Maintaining LaTeX Updated - Part II.

Figure : Search for “ieee” package.



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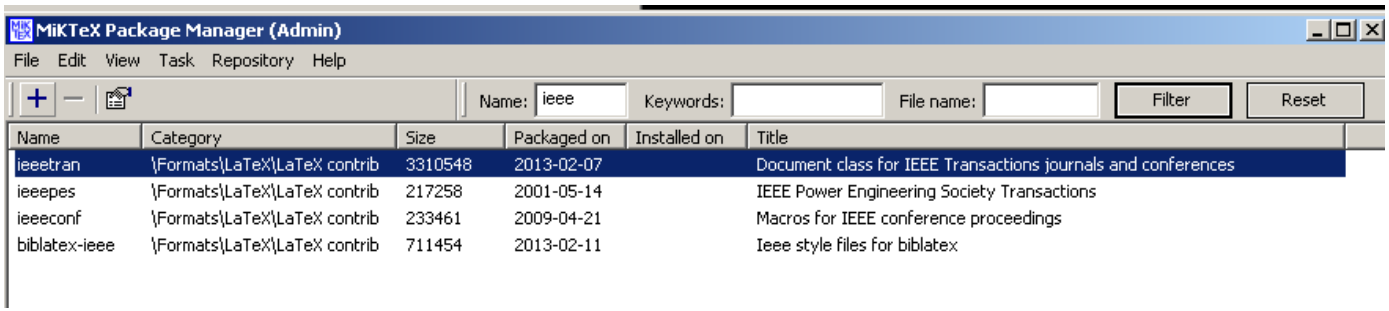
Maintaining LaTeX Updated - Part II.

Figure : You can install by clicking in the "+" sign.



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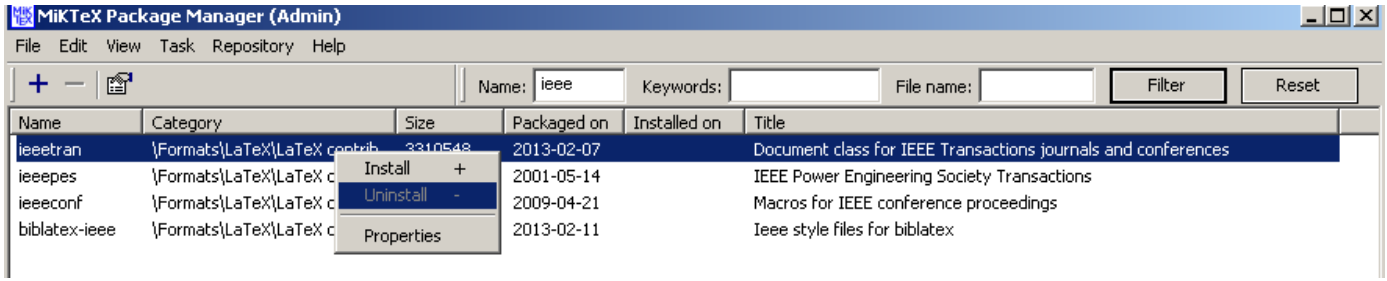
Maintaining LaTeX Updated - Part II.

Figure : Or by pressing the right mouse button.



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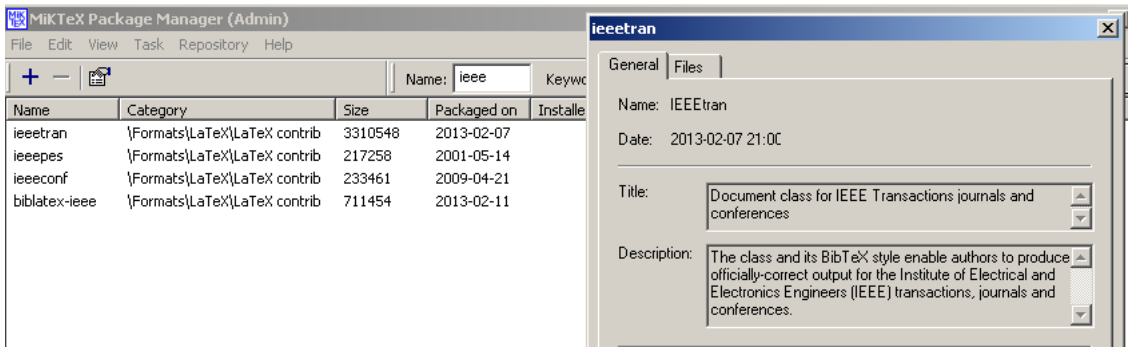
Maintaining LaTeX Updated - Part II.

Figure : Package description.



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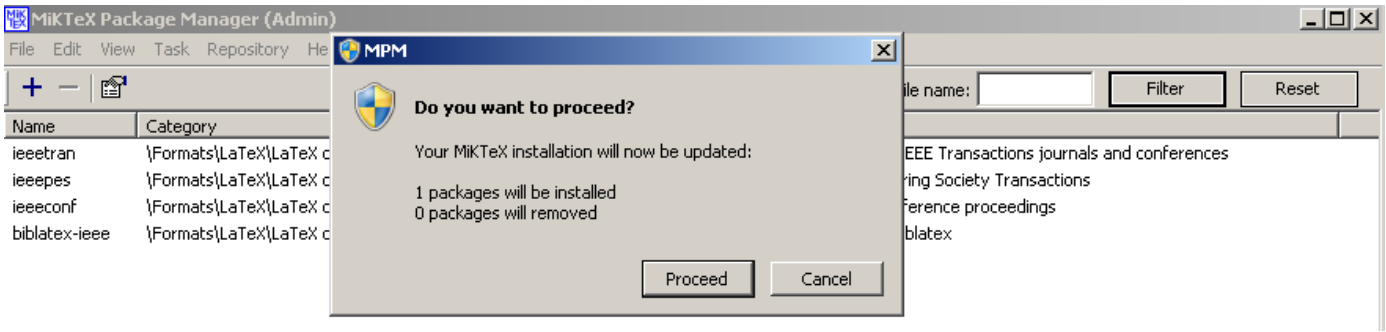
Maintaining LaTeX Updated - Part II.

Figure : Installation confirmation box.



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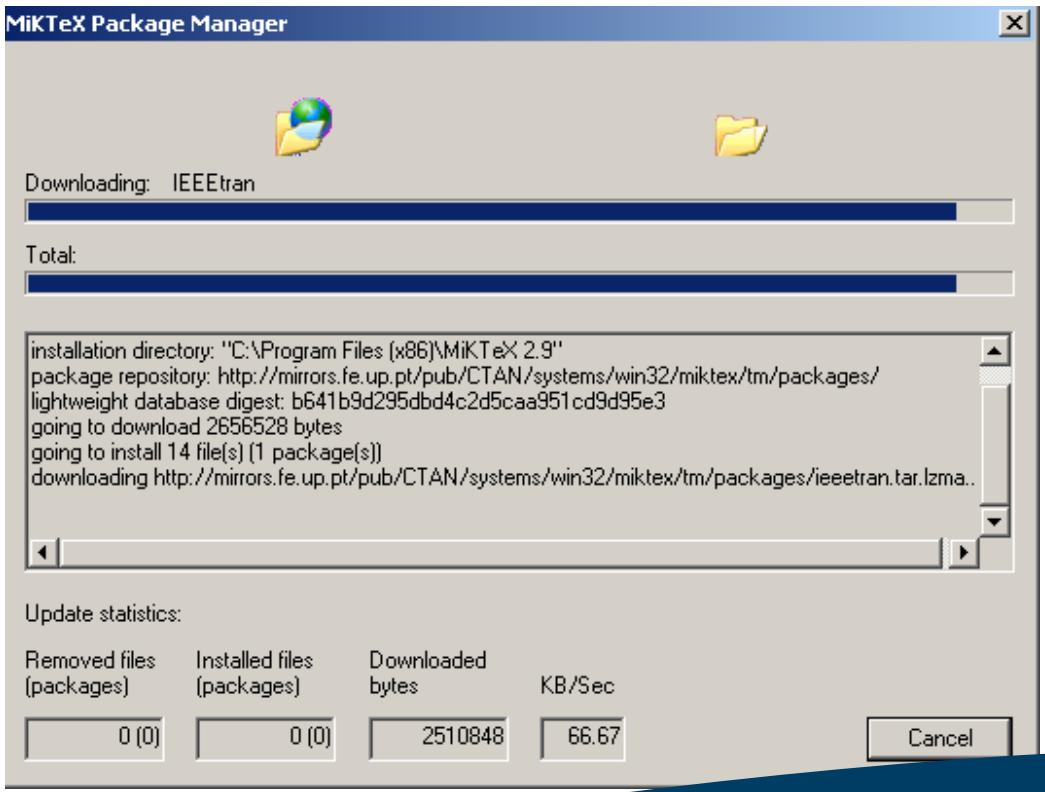
Maintaining LaTeX Updated - Part II.

Figure : Installation.



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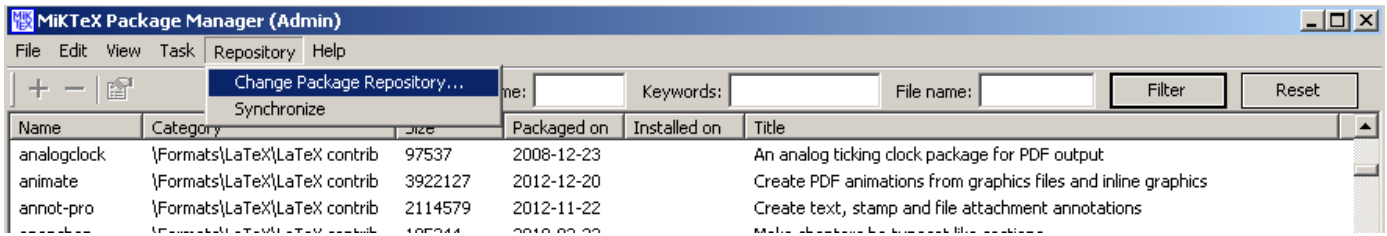
Maintaining LaTeX Updated - Part II.

Figure : Changing package repository.



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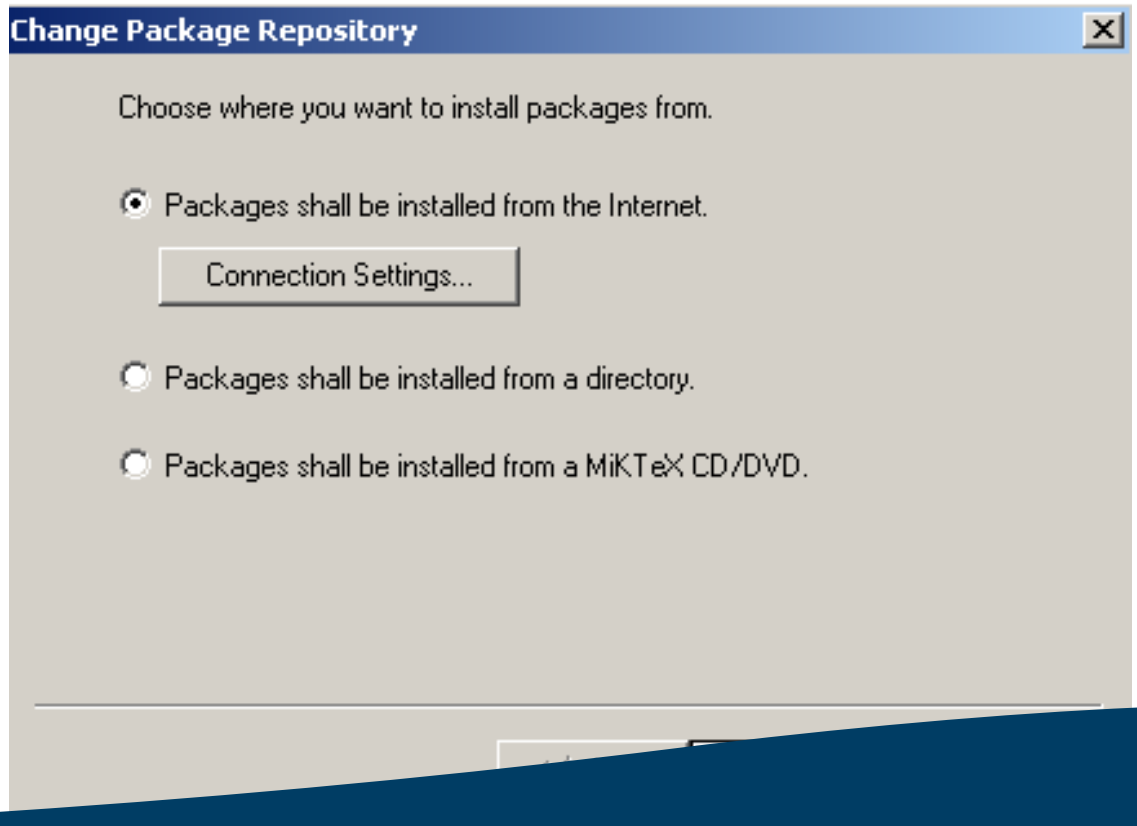
Maintaining LaTeX Updated - Part II.

Figure : Select installation from internet for the most up to date packages.



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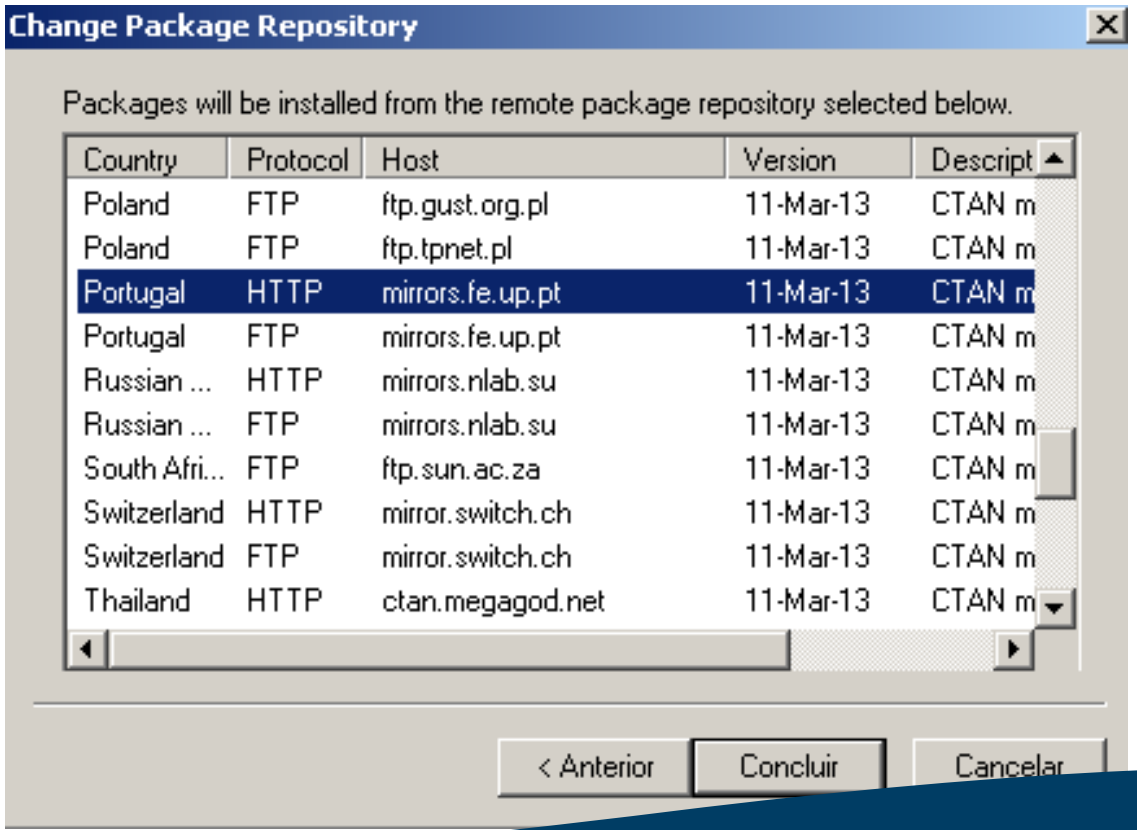
Maintaining LaTeX Updated - Part II.

Figure : Select the closest one.



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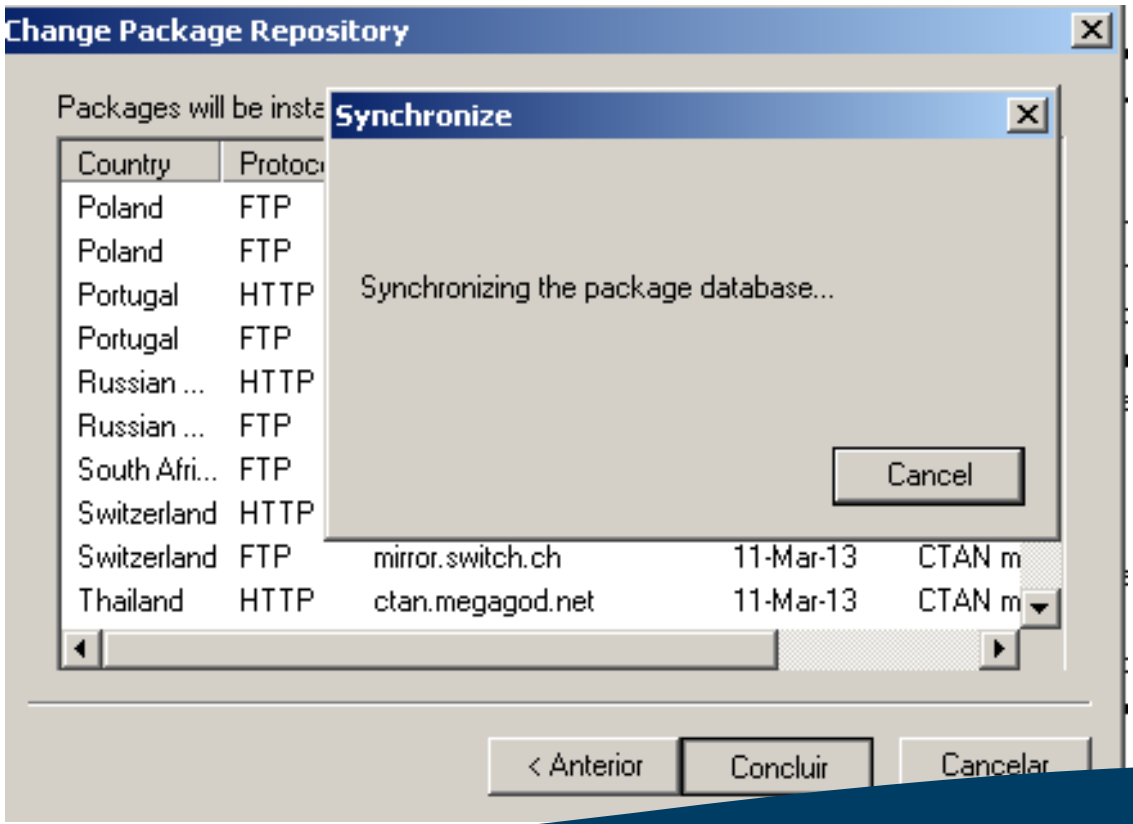
Maintaining LaTeX Updated - Part II.

Figure : And let it synchronize.



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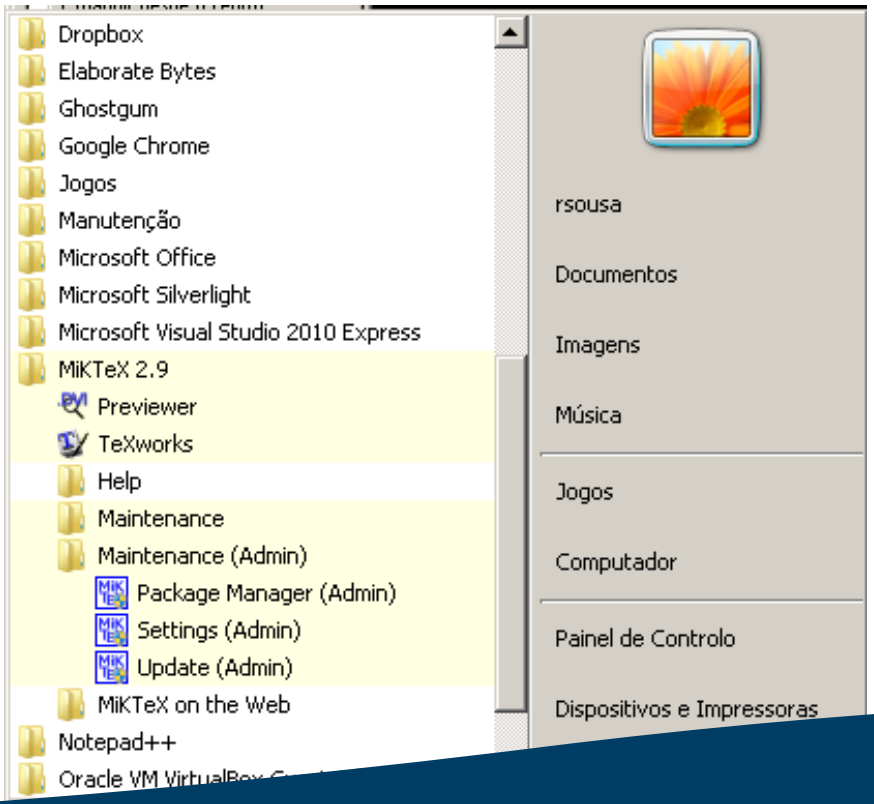
Maintaining LaTeX Updated - Part III.

Figure : MiKTeX maintenance options (select package manager).



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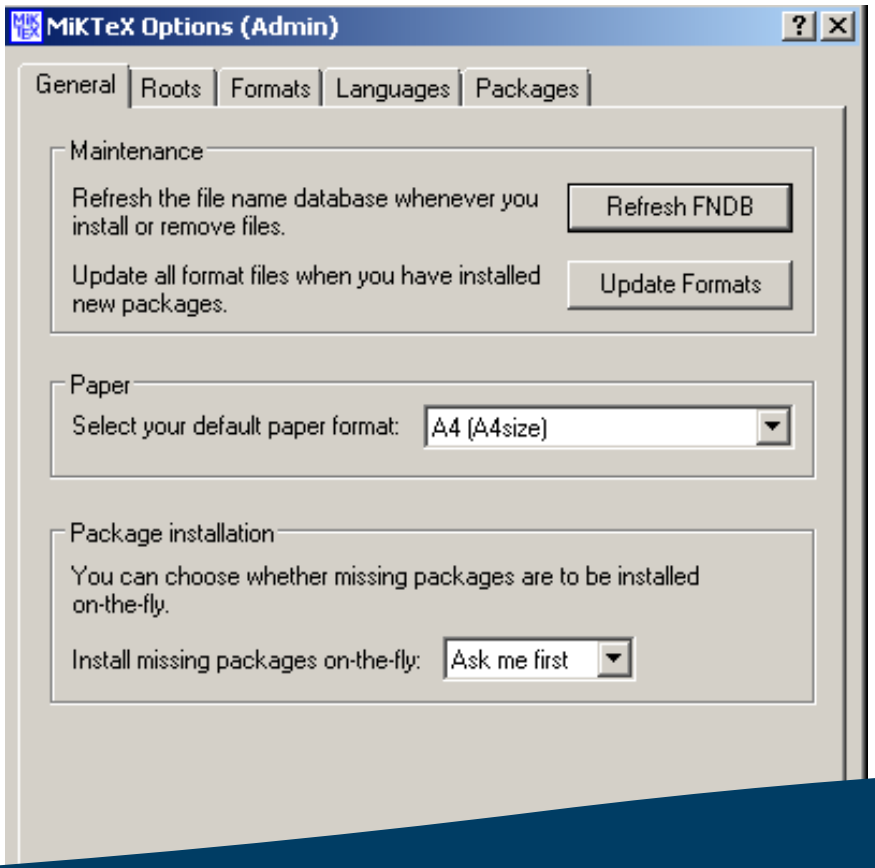
Maintaining LaTeX Updated - Part III.

Figure : Change settings.



Outline.

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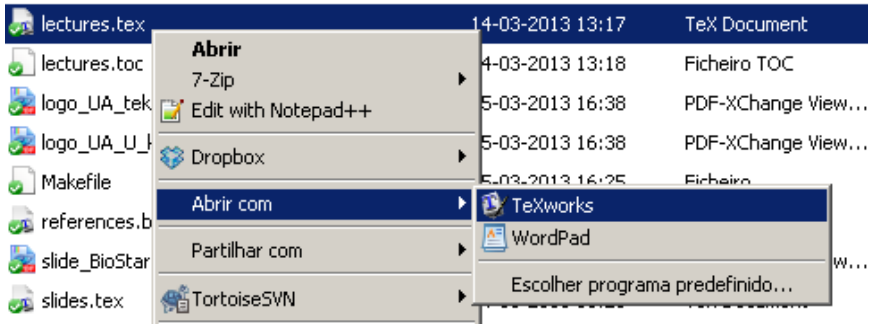
User Interface: TeXworks

Figure : Right click on the main LaTeX file and press "open with" TeXworks.



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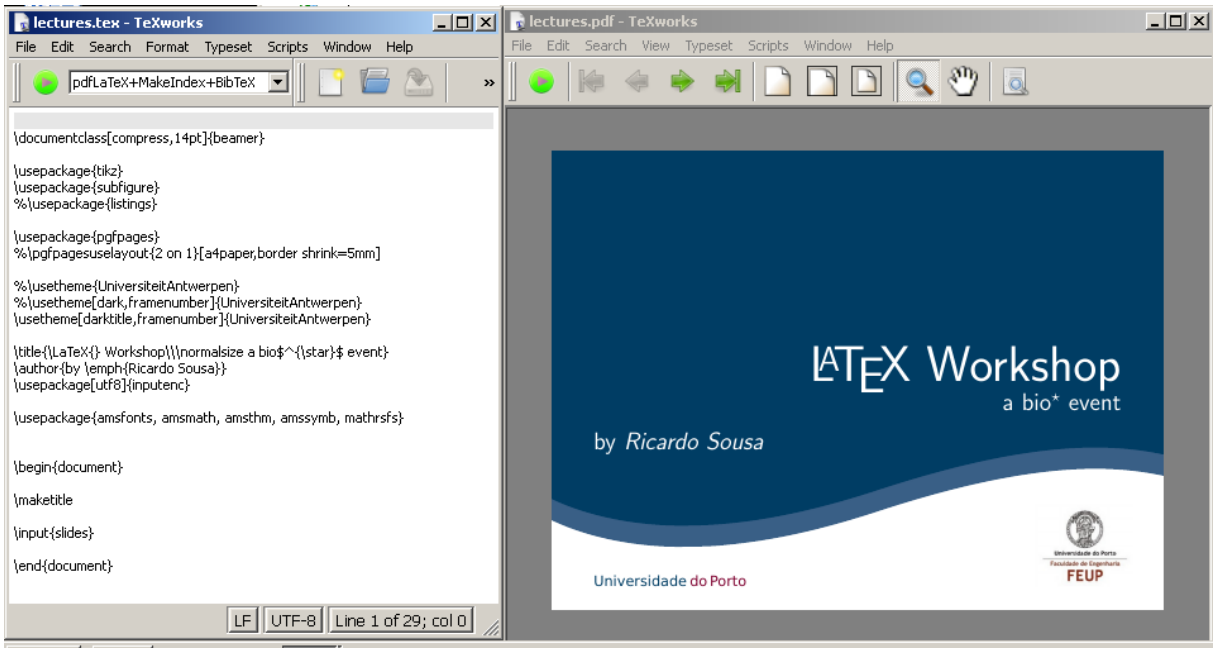
User Interface: TeXworks

Figure : Expected result (for this presentation).



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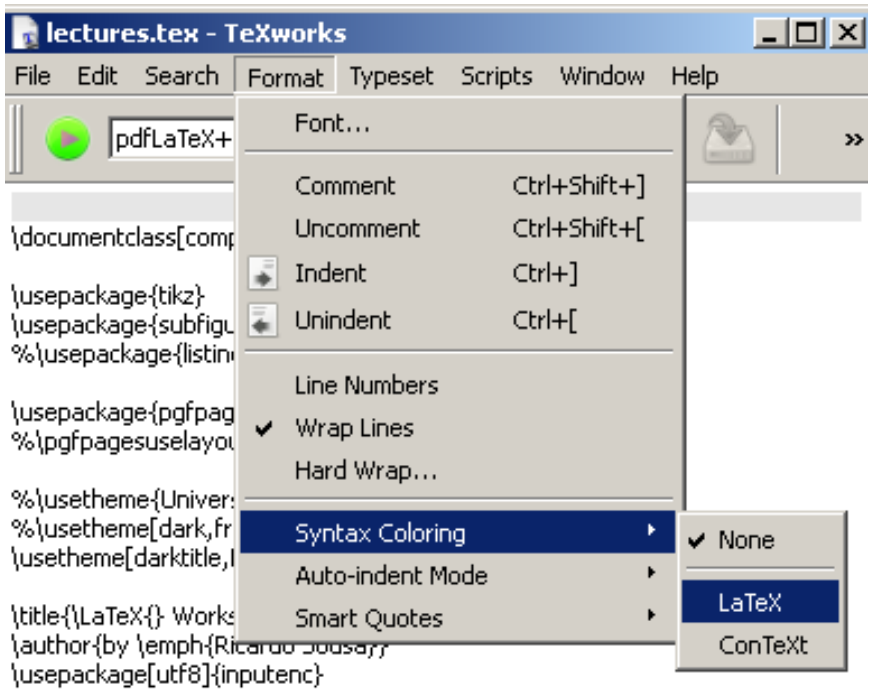
User Interface: TeXworks

Figure : Syntax highlight.



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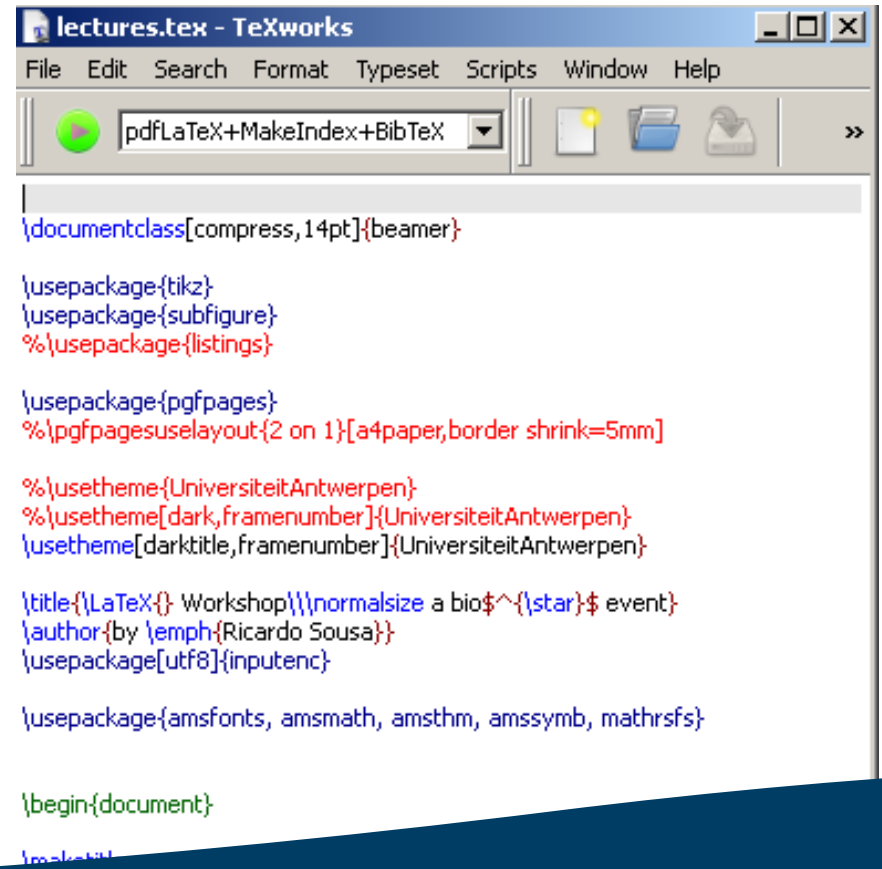
User Interface: TeXworks

Figure : Expected result.



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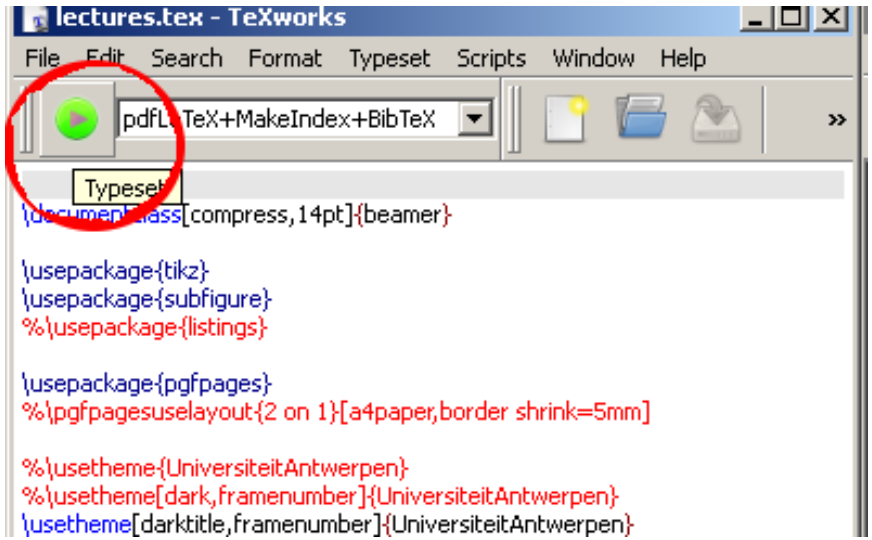
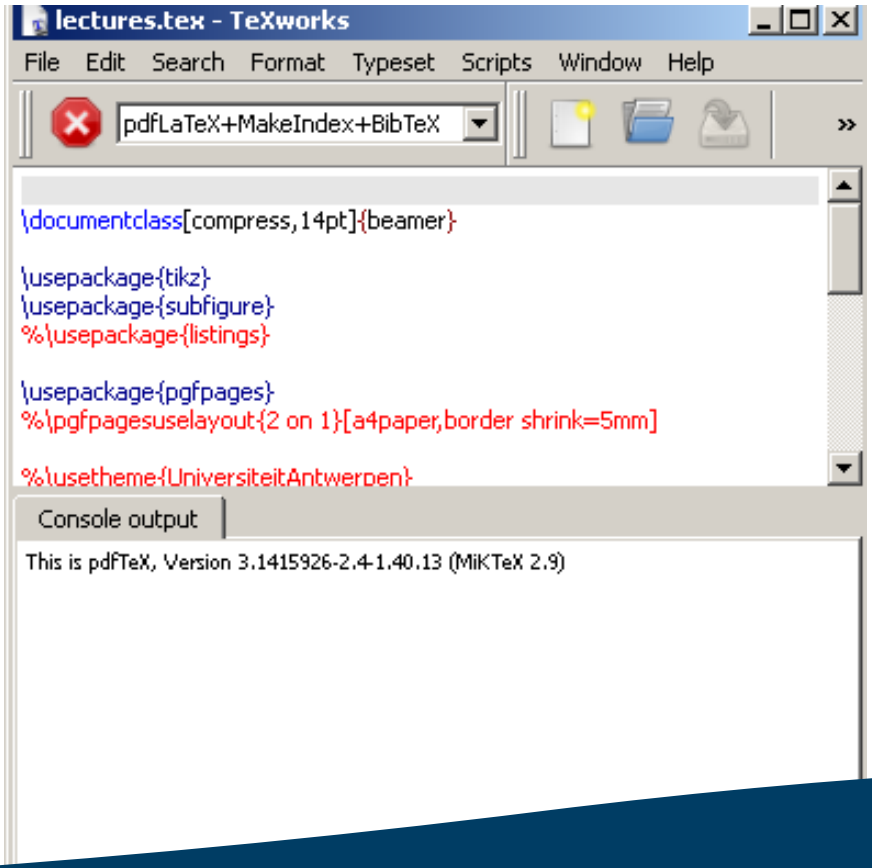
TeXworks: Compiling.

Figure : Compiling.



TeXworks: Compiling.

Figure : Console output.



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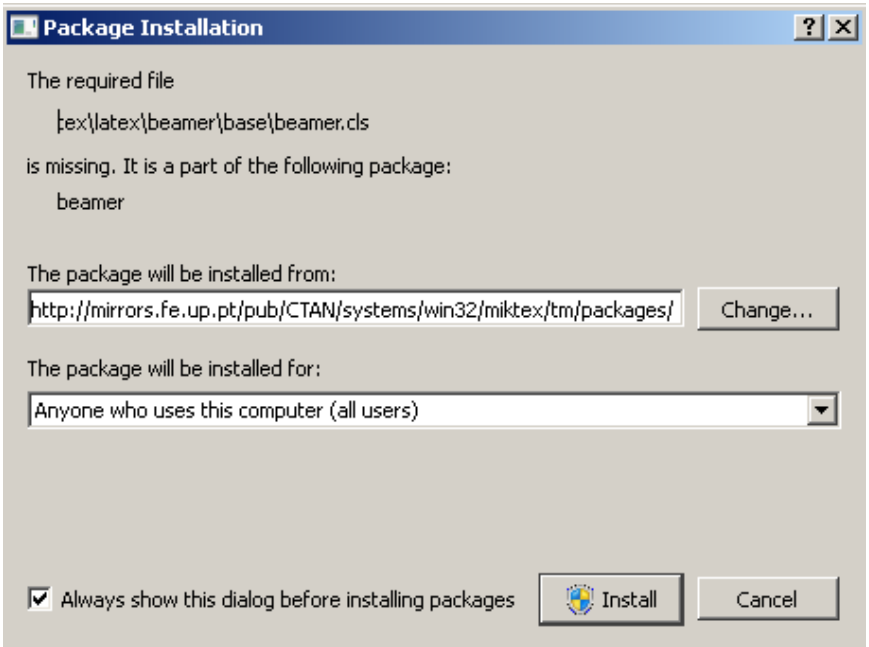
TeXworks: Compiling.

Figure : Pop-up window to install missing packages.



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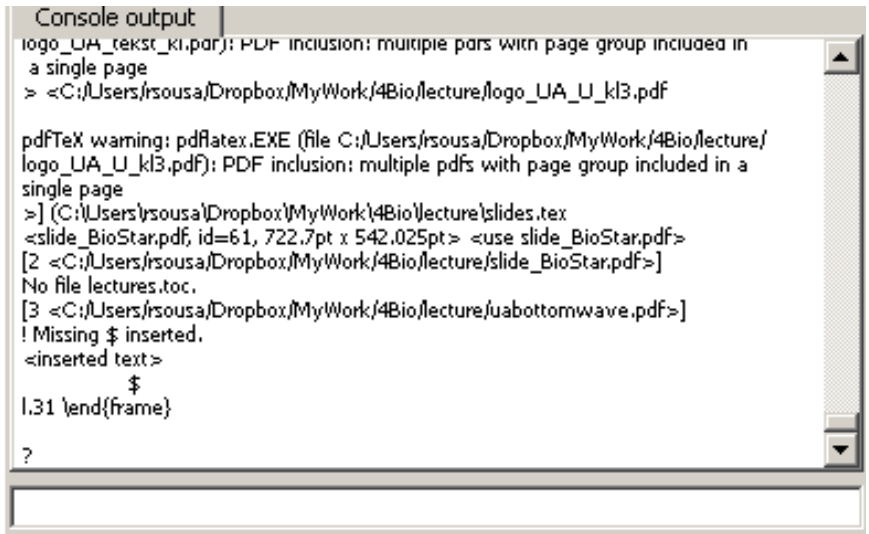
TeXworks: Compiling.

Figure : Compilation unsuccessful.



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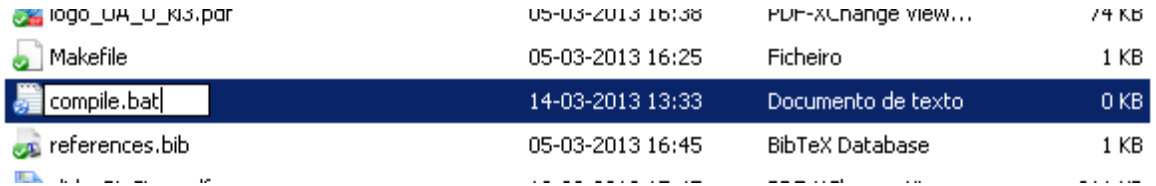
Command line compilation.

Figure : Generating compile script.



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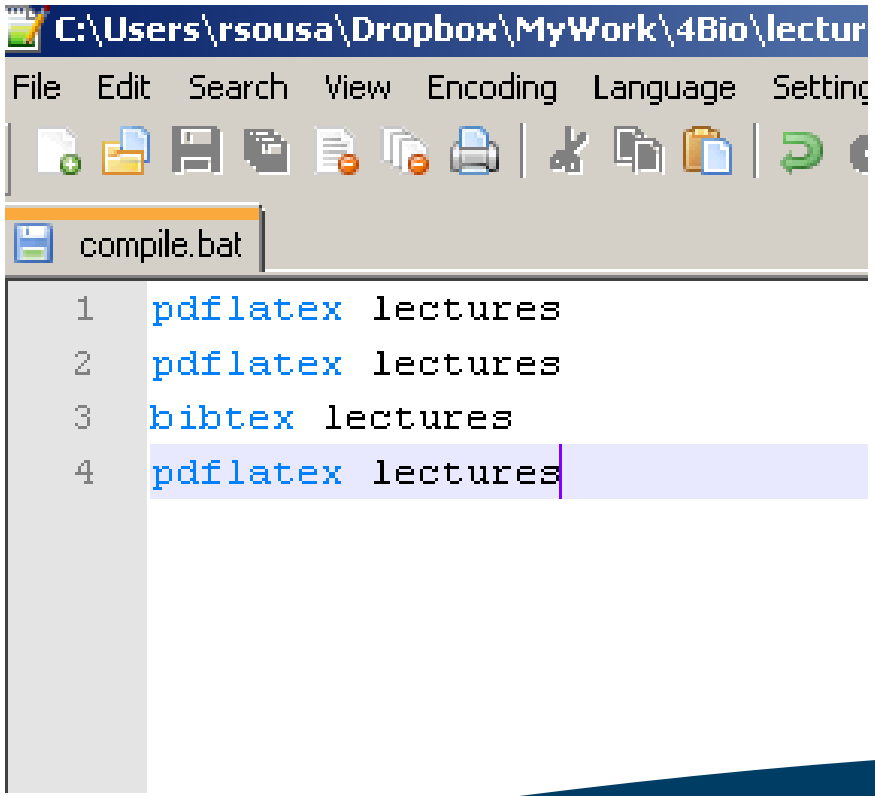
Command line compilation.

Figure : 3 main lines of code.



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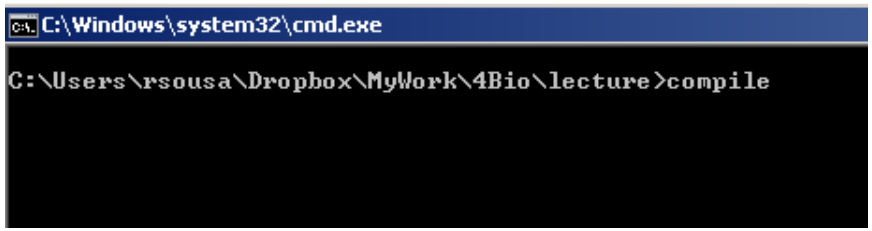
Command line compilation.

Figure : Open a command line window



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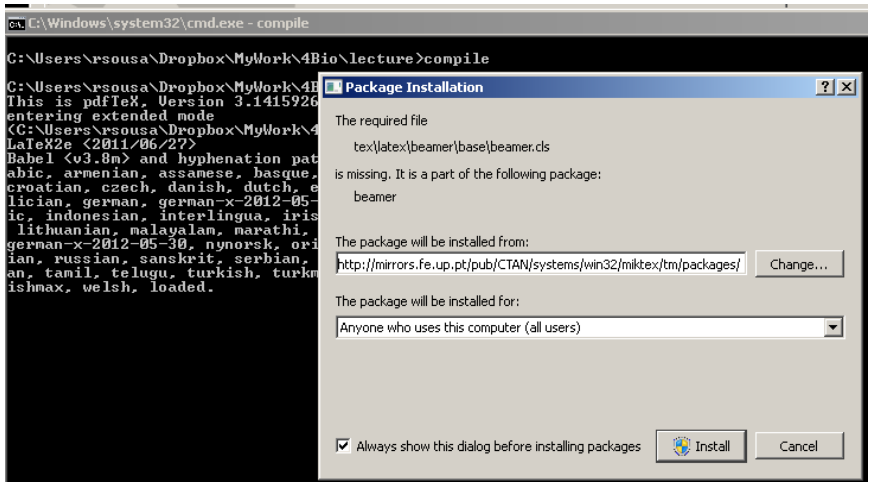
Command line compilation.

Figure : Pop-up window to install missing packages.



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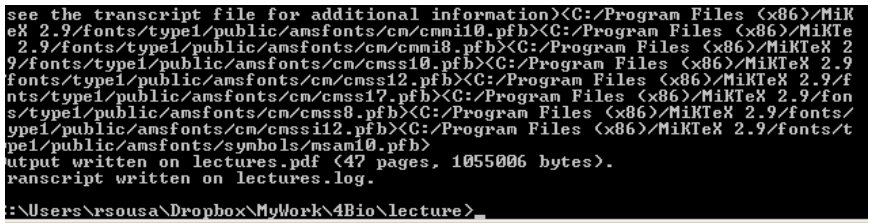
Command line compilation.

Figure : Compilation successful.



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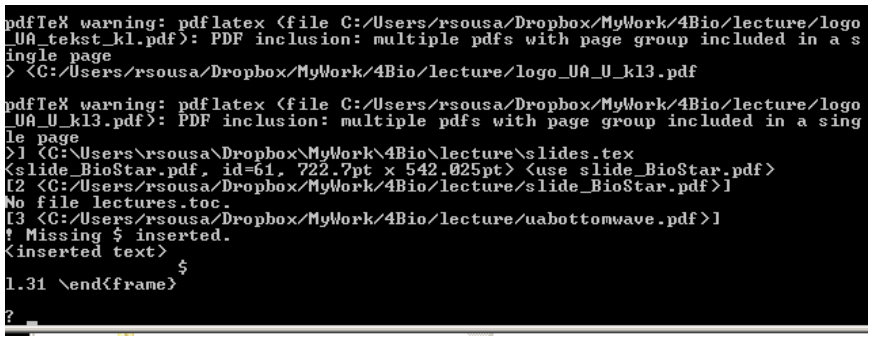
Command line compilation.

Figure : Compilation unsuccessful.



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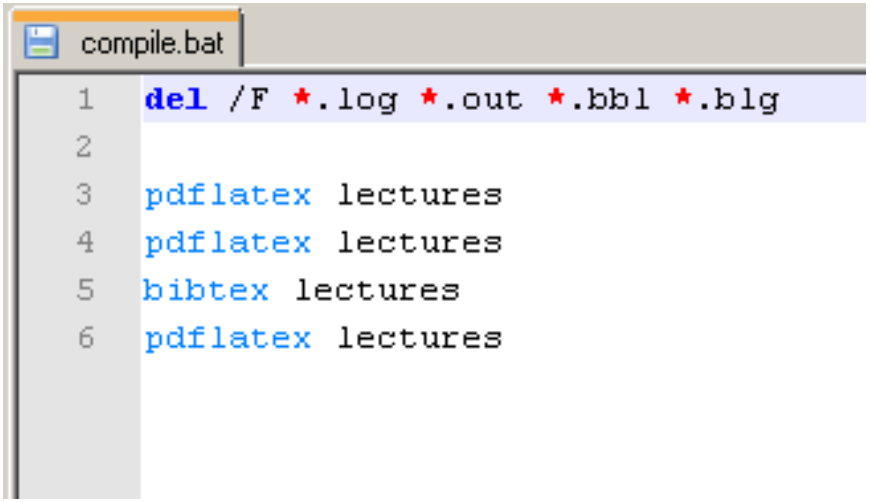
Command line compilation.

Figure : Good practice: erase those auxiliary files.



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Outline.

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```
\documentclass{article}
% preamble
\begin{document}
% core
\end{document}
```

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Typical structure:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\begin{document}
% core
\end{document}
```

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An a4 paper with font size of 10 points:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\begin{document}
% core
\end{document}
```

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Portuguese support:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage[portuguese]{babel}
\begin{document}
% core
\end{document}
```

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Different packages at your disposal:

1. `\usepackage{graphicx}`: figures;
2. `\usepackage{subfig}`: when working with multiple figures;
3. `\usepackage{cite}`: citations;
4. `\usepackage{amsmath}`: mathematical features;
5. `\usepackage{amssymb}`: mathematical symbols;
6. and lots more ...

Check `http://www.ctan.org`.

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Creating Lists:
The itemize environment is for simple lists, the enumerate environment for enumerated lists, and the description environment for descriptions.

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Follows some examples:

```
\begin{enumerate}
\item You can mix the list environments to your taste:
  \begin{itemize}
   \item But it might start to look silly.
   \item[-] With a dash.
 \end{itemize}
\item Therefore remember:
\begin{description}
   \item[Stupid] things will not become smart because they are in a list.
   \item[Smart] things, though, can be presented beautifully in a list.
\end{description}
\end{enumerate}
```

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Including a figure:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}

\begin{document}
\begin{figure}
  \includegraphics{img.pdf}
\end{figure}
\end{document}
```

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```
{\tiny A}
{\scriptsize A}
{\footnotesize A}
{\small A}
{\normalsize A}
{\large A}
{\Large A}
{\LARGE A}
{\huge A}
{\Huge A}
```

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Including a figure:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}
  \includegraphics{img.pdf}
\end{figure}
End of document.
\end{document}
```

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Including a figure (Can you find the difference?):

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h]
  \includegraphics{img.pdf}
\end{figure}
End of document.
\end{document}
```

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Including a figure (Can you find the difference?):

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h] % <-------------- LOOK!!
  \includegraphics{img.pdf}
\end{figure}
End of document.
\end{document}
```

Floating Bodies.

How it affects the document?

- to place a figure/table right here (h);
- or at the bottom (b) of some page;
- or on a special floats page (p);
- and, all this even if it does not look that good (!)
- if no placement specifier is given: [tbp]

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To include figure between two paragraphs:

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h]
  \includegraphics{img.pdf}
\end{figure}

End of document.
\end{document}
```

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Can we change the image size? Yes!

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h]
  \includegraphics[width=0.5\textwidth]{img.pdf}
\end{figure}

End of document.
\end{document}
```

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Can we center the image? Of course!

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h]
  \centering
  \includegraphics[width=0.5\textwidth]{img.pdf}
\end{figure}

End of document.
\end{document}
```

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Can we center the image? Another way!

```
\documentclass[twoside,a4paper,10pt]{article}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\begin{document}

Logo.
\begin{figure}[!h]
  \begin{center}
  \includegraphics[width=0.5\textwidth]{img.pdf}
  \end{center}
\end{figure}

End of document.
\end{document}
```

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And what about captions? Easy stuff :)

```
\begin{figure}[!h]
  \centering
  \includegraphics[width=0.5\textwidth]{img.pdf}
  \caption{Faculty Logo.}
\end{figure}
```

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Including more than one figure.

```
\begin{figure}[!h]
  \centering
  \includegraphics[width=0.5\textwidth]{img.pdf}
  \includegraphics[width=0.5\textwidth]{img.pdf}
  \caption{Faculty Logo.}
\end{figure}
```

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However, we should use package 'subfig' which provides support for the inclusion of small, 'sub', figures and tables.

```
...
\usepackage{subfig}
\begin{document}
...
\begin{figure}[!h]
\subfloat[Imagem 1.]{\includegraphics[width=0.5\textwidth]{img.pdf}}
\subfloat[Imagem 2.]{\includegraphics[width=0.5\textwidth]{img.pdf}}
\end{figure}
```

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How to create tables? The simplest way is:

```
\begin{tabular}{ccc}
Evolutionary & SA & Simulated Annealing \\
\end{tabular}
```

- *tabular* is the environment for tables;
- Triple "c" for three columns with centered (c) text;
- "&" is the column separator;
- \\ is the new line;

Creating my first LaTeX Manuscript

How to create tables? The simplest way is:

```
\begin{tabular}{|p{3cm}|c|c|}
Evolutionary & SA & Simulated Annealing \\
\end{tabular}
```

- besides "c" we can have:
  - `l`: left;
  - `r`: right;
  - `p{2cm}`: paragraph with 2cm width.
- we can also stylish our table by putting bars `|.|`

Creating my first LaTeX Manuscript

How to create tables? The simplest way is:

```
\begin{tabular}{|p{3cm}|c|c|}
\hline
Evolutionary & ZO & Genetic Algorithm\\
Evolutionary & SA & Simulated Annealing \\
\hline
\end{tabular}
```

adding horizontal lines with `\hline`

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Merging cells (rows).

```
\usepackage{multirow}
...
\begin{document}
\begin{tabular}{|p{3cm}|c|c|}
\hline
\multirow{2}{*}{Evolutionary} & ZO & Genetic Algorithm\\
                              & SA & Simulated Annealing \\
\hline
\end{tabular}
...
\end{document}
```

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Merging cells (columns).

```
\begin{tabular}{|p{3cm}|c|c|}
\hline
\multicolumn{3}{|c|}{Heuristic Algorithms} \\
\hline
\multirow{2}{*}{Evolutionary} & ZO & Genetic Algorithm\\
                              & SA & Simulated Annealing \\
\hline
\end{tabular}
```

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```
\begin{table}[!t]
\begin{tabular}{|p{3cm}|c|c|}
\hline
\multicolumn{3}{|c|}{Heuristic Algorithms} \\
\hline
\multirow{2}{*}{Evolutionary} & ZO & Genetic Algorithm\\
                              & SA & Simulated Annealing \\
\hline
\end{tabular}
\caption{Table of some Heuristic Algorithms.}
\end{table}
```

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How can we reference tables in the document?

```
\begin{table}[!t]
\begin{tabular}{|p{3cm}|c|c|}
\hline
\multicolumn{3}{|c|}{Heuristic Algorithms} \\
\hline
\multirow{2}{*}{Evolutionary} & ZO & Genetic Algorithm\\
                              & SA & Simulated Annealing \\
\hline
\end{tabular}
\caption{Table of some Heuristic Algorithms.}
\label{tab:table}
\end{table}
Please check Table~\ref{tab:table}.
```

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Can I divide my document by sections? Of course

```
\section{Introduction}
...
\section{State-of-the-Art}
\subsection{Biology Concepts}
...
\subsection{Image Processing}
...
\subsection{Pattern Recognition}
...
```

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References can be used anywhere.

```
\section{Introduction}
\label{sec:intro}
...
\section{State-of-the-Art}
\label{sec:soa}
\subsection{Biology Concepts}
\label{sec:bio}
...
\subsection{Image Processing}
\label{sec:ip}
...
\subsection{Pattern Recognition}
\label{sec:pr}
...

Further image processing details can be found in Section~\ref{sec:ip}.
```

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Document can also be divided in parts, chapters and so on.

```
\documentclass[twoside,a4paper,10pt]{book}
...
\begin{document}
\part{Basic Concepts: Part I}
\chapter{Beginning}
\section{How does it starts?}

\part{Basic Concepts: Part II}
\end{document}
```

Creating my first LaTeX Manuscript

Title, authors..

```
\documentclass[twoside,a4paper,10pt]{book}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\usepackage{multirow}

\title{Book Sample}
\begin{document}
\tableofcontents % simple, isn't it?

\part{Basic Concepts: Part I}
\chapter{Beginning}
\section{How does it starts?}

\part{Basic Concepts: Part II}
\end{document}
```

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maketitle after the \begin{document}

```
\documentclass[twoside,a4paper,10pt]{book}
% preamble
\usepackage[utf8]{inputenc} % general input encondings
\usepackage{graphicx}
\usepackage{multirow}

\title{Book Sample}
\begin{document}
\maketitle % tells latex to put title here!
\tableofcontents % simple, isn't it?

\part{Basic Concepts: Part I}
\chapter{Beginning}
\section{How does it starts?}

\part{Basic Concepts: Part II}
\end{document}
```

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author and date

```
\title{Book Sample}
\author{X and Y}
\date{16/03/2013}
\begin{document}
\maketitle
\tableofcontents % simple, isn't it?
```

It is also possible to specify current date through command `\date{\today}`

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Mathematical Formulas

```
\begin{equation}
e = mc^2
\label{eq:massenergy}
\end{equation}
Mass Energy Einstein equivalence formula (Eq.~\ref{eq:massenergy}).
```

- equation environment;
- $\wedge$ is for superscript text.

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Mathematical Formulas (summations):

```
\begin{equation}
1/N \sum_{i=1}^N x_i
\end{equation}
```

- $\vee$ is for subscript;
- / can be substituted by `\frac{1}{N}` (output result will be different, $\frac{1}{N}$).

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Symbols:

```
\alpha   \theta       \tau
\beta    \vartheta    \pi
\gamma   \gamma       \varpi
```

You do not need know them by heart. Check
`http://www.tex.ac.uk/tex-archive/info/symbols/comprehensive/symbols-a4.pdf`

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Symbols:

$$\alpha \quad \theta \quad \tau \tag{1}$$
$$\beta \quad \vartheta \quad \pi \tag{2}$$
$$\gamma \quad \gamma \quad \varpi \tag{3}$$

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Mathematical Formulas (without numbering):

```
\begin{equation*}
1/N \sum_{i=1}^N x_i
\label{eq:avg}
\end{equation*}
Average formula (Eq.~\ref{eq:avg}).
```

What you think that will happen?

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Mathematical Formulas (without numbering):

```
\begin{equation*}
1/N \sum_{i=1}^N x_i
\label{eq:avg}
\end{equation*}
Average formula (Eq.~\ref{eq:avg}).
```

What you think that will happen? The $\star$ symbol can be also applied in tables, figures, sections, ...

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Mathematical Formulas (inline):

```
$1/N \sum_{i=1}^N x_i$
```

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Mathematical Formulas (inline):

```
$1/N \sum_{i=1}^N x_i$
```

you can also put inline formulas centered in the text

```
\[
1/N \sum_{i=1}^N x_i
\]
```

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Finally, we also may need to add some bibliographic references.
Add `bibtex` to the compilation script (TeXworks already does this!).

```
pdflatex document
pdflatex document
bibtex document
pdflatex document
```

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You need to create a file for the references (named it references.bib) and the following content:

```
book{calder1979einstein,                          % key
  title={Einstein's universe},                    % title
  author={Calder, Nigel and Albert, Einstein},    % author
  year={1979},                                    % year
  publisher={Viking Press}                        % publisher
}
```

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In your LaTeX main file you should call now the bibliography file.

```
\begin{document}

\begin{equation}
e = mc^2
\label{eq:massenergy}
\end{equation}
Mass Energy Einstein equivalence formula (Eq.~\ref{eq:massenergy}).

\bibliographystyle{plain}
\bibliography{references}

\end{document}
```

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Previous gave a warning when generating the references list. Do you know why?

Creating my first LaTeX Manuscript

Previous gave a warning when generating the references list. Do you know why?

```
\begin{document}

\begin{equation}
e = mc^2
\label{eq:massenergy}
\end{equation}
Mass Energy Einstein equivalence formula
(Eq.~\ref{eq:massenergy})~\cite{calder1979einstein}.

\bibliographystyle{plain}
\bibliography{references}

\end{document}
```

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Bibliography

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Documentation for the ubcthesis_new latex class.
2011.

Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl.
The not so short introduction to LaTeX, 2010.

Sources of Information.

More documentation can also be found in the following references:

1. `http://www.latex-project.org/`
2. `http://www.ctan.org`
3. `http://www.texdoc.net/`

. . . and, of course . . .

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Sources of Information.

More documentation can also be found in the following references:

1. `http://www.latex-project.org/`
2. `http://www.ctan.org`
3. `http://www.texdoc.net/`

...and, of course ... `http://www.google.com`

Exercises.