LaTeX for Beginners

This short document should help you get started with LaTeX. You can also find a lot of documentation on the web, for instance `http://en.wikibooks.org/wiki/LaTeX`, and of course the full documentation of packages on CTAN `http://ctan.org/`.

1 Installing a LaTeX Distribution

The TeX "environment" is a pretty large one, including processing programs, libraries, fonts, and many extensions.

1.1 Installing a Distribution

The most comprehensive distribution is TeX Live `http://tug.org/texlive/`, and can be installed on your favorite operating system:

GNU/Linux preferably use the package manager of your GNU/Linux distribution to install TeX Live,

MacOS X use MacTeX `http://tug.org/mactex/` or your package manager (for instance MacPorts `http://macports.org`),

Microsoft Windows use the TeX Live distribution for Windows or MiKTeX `http://miktex.org/`.

Unless you are short on disk space, you can start right away with a full installation (which might use several GiBs!).

1.2 Updating a Distribution

If you installed your TeX distribution through a general-purpose package manager, use that. If you installed TeX Live directly, then you can maintain your TeX installation through the *TeX Live package manager* `tlmgr`: see `http://www.tug.org/texlive/tlmgr.html`. If you installed MiKTeX, there is a *MiKTeX update wizard* tool to maintain your installation: see `http://docs.miktex.org/2.9/manual/updating.html`.

2 Running LaTeX

A LaTeX document is a plain text document. It is interpreted by a TeX processor that outputs a formatted document (here a PDF file).

2.1 The Basics

Example 1 (A Minimal Document)**.** A minimal LaTeX document looks like the following:

```
\documentclass{article}
\begin{document}
  Hello, world!
\end{document}
```

The "\documentclass{article}" instruction selects the type of document we want to generate (here an "article"), while the "document" environment delimits the main contents of our document.

If this is the content of a file named `example1.tex`, then running

```
# pdflatex example1.tex
```

on the command line will result in a PDF file `example1.pdf` (among others).

2.1.1 Basic Typesetting

Paragraphs are simply separated by blank lines:

```
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut molestie
nunc ac erat consectetur scelerisque. Lorem ipsum dolor sit amet,
consectetur adipiscing elit. Sed ante velit, aliquam at faucibus
sed, varius in metus. Curabitur ut libero et ligula mollis fermentum
a sit amet urna. Etiam eu sapien leo, ac lobortis odio. Donec
tempor, magna vel lobortis blandit, quam mi fringilla neque, nec
sagittis nisi leo eu tortor. Nunc rhoncus urna a lectus auctor eu
fringilla nulla accumsan.

Aliquam erat volutpat. Vivamus euismod consectetur
ultricies. Maecenas vel sem sed lectus consequat vulputate. Etiam in
orci massa. Sed eros nisl, aliquam vitae pulvinar nec, lobortis sit
amet nisl. Donec metus leo, accumsan et ultricies vel, elementum id
leo. Donec tempus nibh sed est interdum cursus.
```

will result in two paragraphs:

> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut molestie nunc ac erat consectetur scelerisque. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ante velit, aliquam at faucibus sed, varius in metus. Curabitur ut libero et ligula mollis fermentum a sit amet urna. Etiam eu sapien leo, ac lobortis odio. Donec tempor, magna vel lobortis blandit, quam mi fringilla neque, nec sagittis nisi leo eu tortor. Nunc rhoncus urna a lectus auctor eu fringilla nulla accumsan.
>
> Aliquam erat volutpat. Vivamus euismod consectetur ultricies. Maecenas vel sem sed lectus consequat vulputate. Etiam in orci massa. Sed eros nisl, aliquam vitae pulvinar nec, lobortis sit amet nisl. Donec metus leo, accumsan et ultricies vel, elementum id leo. Donec tempus nibh sed est interdum cursus.

Paragraph jumps can also be triggered through the "\par" directive.

LaTeX handles rather well line breaks, page breaks, hyphenation, etc., thus there is usually no need to use the commands "\\", "\newline", or "\linebreak" for line breaks, "\clearpage" or "\pagebreak" for page breaks, nor "\-" for hyphenations.

Text styles, to be used sparingly in the main text, are set through the commands "\textbf{...}" for **bold face**, "\textit{...}" for *italics*, "\textsl{...}" for *slanted*, "\textsf{...}"

for sans-serif, "**texttt**{...}" for `typewriter`, and "**textsc**{...}" for Small Caps. Much more useful: the *emphasis* "**emph**{...}", which emphasizes depending on the surrounding font.

Finally, a number of symbols are reserved and should be escaped or replaced: "\%" because "%" is used to start a comment line, "\$" because "$" delimits inline maths, "\~{}" because "~" denotes an unbreakable space, "\#", "_", "\&", "\{", "\}", and "**textbackslash**" (or in math mode) for "\", and "**textasciicircum**{}" (or "**hat**{}" in math mode) for "^".

2.1.2 Sectioning

The text can be sectioned into parts, chapters etc. using "**part**{Title of the Part}", "**chapter**{Title of the Chapter}" (parts and chapters are not available in the "article" class of documents; one needs to use e.g. "book" or "report"), "**section**{Title of the Section}", "**subsection**{...}", "**subsubsection**{...}", "**paragraph**{...}", and "**subparagraph**{...}". Appendices start after the "**appendix**" command.

A table of contents is automatically inserted by the "**tableofcontents**" command; this requires *two* compilations by the `pdflatex` program: a first pass generates an auxiliary file which is read during the second pass to construct the table.

Here is for instance the table of contents for this document:

Contents

2.1.3 Lists

Example 2 (Lists)**.** LaTeX provides three predefined list environments: "itemize", "enumerate", and "description":

```
\begin{description}
\item[itemize] lists are used for generic, ``bulleted lists'':
  \begin{itemize}
  \item something
    \begin{itemize}
    \item that we can refine into something else
    \item or yet another thing
    \end{itemize}
  \item something different.
  \end{itemize}
\item[enumerate] lists are for numbered lists:
  \begin{enumerate}
  \item a first point
    \begin{enumerate}
    \item a first subpoint
    \item a second subpoint
    \end{enumerate}
  \item a second point.
  \end{enumerate}
\item[description] lists are for lists of entries along with their
  descriptions.
\end{description}
```

results in

itemize lists are used for generic, "bulleted lists":
- something
  - that we can refine into something else
  - or yet another thing
- something different.

enumerate lists are for numbered lists:
1. a first point
   (a) a first subpoint
   (b) a second subpoint
2. a second point.

description lists are for lists of entries along with their descriptions.

2.1.4 Mathematics

Math Mode LaTeX has two main modes of interpretation: *text mode* for plain text, and *math mode* for mathematics. The latter can be used *inline* by delimiting with "$...$", for instance to write $(x+y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k$, or as a *block* using "$$...$$" or "\[...\]",

as in

$$(x+y)^n=\sum_{k=0}^{n}\binom{n}{k}x^{n-k}y^k\;,$$

which was typeset by

```
$$(x+y)^n=\sum_{k=0}^n\binom nk x^{n-k}y^k\;,$$
```

(the "\binom" command requires "amsmath"; see Section 3.2).

Equations When writing maths in blocks, the environments proposed by $\mathcal{AMS}$-LaTeX are recommended instead of the plain "$$...$$"; for instance,

```
\usepackage{amsmath}
...
\begin{document}
\begin{equation}
  (x+y)^n=\sum_{k=0}^n\binom nk x^{n-k}y^k\;.
\end{equation}
\end{document}
```

results in

$$(x+y)^n=\sum_{k=0}^{n}\binom{n}{k}x^{n-k}y^k\;. \tag{1}$$

See Section 3.2 for more on $\mathcal{AMS}$-LaTeX.

Symbols LaTeX comes with a lot of commands for mathematical symbols: see `http://www.ctan.org/tex-archive/info/symbols/comprehensive/symbols-a4.pdf` for a *big* list. Beware that latin characters in math mode are interpreted as *variables* and typeset accordingly; contrast

```
\begin{align}
  argmax_{i\in I} &\mathit{argmax}_{i\in I} &\mathop{\mathrm{argmax}}_{i\in I}
\end{align}
```

$$\begin{aligned} argmax_{i\in I} \qquad & \mathit{argmax}_{i\in I} \qquad & \operatorname*{argmax}_{i\in I} \end{aligned} \tag{2}$$

2.1.5 Tables

Tables tend to be annoying in LaTeX. The basic environment "tabular" is rather poor, and one often has to resort to the more advanced environments provided by the packages "array" (for fine-grained column specifications), "multirow" (for cells spanning multiple rows), "tabularx" (for extensible columns), and "longtable" (for tables spanning over several pages).

Example 3. The table layouts found in LaTeX documents tend to overuse vertical lines, and to have improper spacing. Here is an example of the nice results one obtains with the "booktabs" package (see Section 3 on the use of packages):

```
\usepackage{booktabs}
...
\begin{tabular}{lccc} % 4 columns: 1 left-aligned and 3 centered
  \toprule
  \multicolumn{3}{c}{Problems}\\
  \cmidrule(r){1-3}
  Name & Input & Question & Complexity \\
  \midrule
  Membership & $\langle\mathcal{A},w\rangle$ &
    $w\in L(\mathcal{A})$? & \textsc{NLogSpace}-complete\\
  Emptiness & $\langle\mathcal{A}\rangle$ &
    $L(\mathcal{A})=\emptyset$? & \textsc{NLogSpace}-complete\\
  Universality & $\langle\mathcal{A}\rangle$ &
    $L(\mathcal{A})=\Sigma^\ast$? & \textsc{PSpace}-complete\\
  \bottomrule
\end{tabular}
```

results in

	Problems		
Name	Input	Question	Complexity
Membership	$\langle \mathcal{A}, w\rangle$	$w \in L(\mathcal{A})$?	NLogSpace-complete
Emptiness	$\langle \mathcal{A}\rangle$	$L(\mathcal{A}) = \emptyset$?	NLogSpace-complete
Universality	$\langle \mathcal{A}\rangle$	$L(\mathcal{A}) = \Sigma^*$?	PSpace-complete

2.2 Further Tools

More TeX Dialects LaTeX is by no means the only text processor built on top of TeX. One alternative is ConTeXt `http://wiki.contextgarden.net/`, which emphasizes the ease of modifying the layout and typography, or XeTeX `http://scripts.sil.org/xetex`, which provides an improved support of fonts and typography. Both are distributed along with your TeX environment.

2.2.1 BibTeX

LaTeX manages bibliographies as provided by a "thebibliography" environment. It is however much easier to rely on BibTeX to generate the contents of this environment, based on the citations found in the main text.

Example 4 (Bibliography)**.** A citation in the main text is triggered by the "\cite{key}" command, where "key" is the key of the bibliographic entry of interest. When running `pdflatex`, information about citations is saved to an `.aux` auxiliary file, which BibTeX reads to generate a `.bbl` file containing the desired "thebibliography" environment. This file is read on a next pass of `pdflatex`, and one more pass is necessary before the links between the citations and the bibliography are made:

Contents of `example2.tex`

```
\documentclass{article}
\begin{document}
See \cite{TeX,LaTeX}, but really look at \cite{latexcomp}.

\bibliographystyle{plain}
\bibliography{mybib}
\end{document}
```

Contents of `mybib.bib`

```
@book{TeX,
  author    = {Donald E. Knuth},
  title     = {The \TeX{}book},
  publisher = {Addison-Wesley},
  year      = 1984,
}
@book{LaTeX,
  author    = {Leslie Lamport},
  title     = {\LaTeX\string: {A} Document Preparation System},
  publisher = {Addison-Wesley},
  edition   = 2,
  year      = 1994,
}
@book{latexcomp,
  author    = {Frank Mittelbach and Michel Goossens},
  title     = {The \LaTeX\ Companion\string: Tools and Techniques
               for Computer Typesetting},
  publisher = {Addison-Wesley},
  edition   = 2,
  year      = 2004,
}
```

Then running

```
# pdflatex example2
# bibtex example2
# pdflatex example2
# pdflatex example2
```

will result in:

See [1; 2], but really look at [3].

References

[1] Donald E. Knuth. *The TeXbook*. Addison-Wesley, 1984.

[2] Leslie Lamport. *LaTeX: A Document Preparation System*. Addison-Wesley, second edition, 1994.

[3] Frank Mittelbach and Michel Goossens. *The LaTeX Companion: Tools and Techniques for Computer Typesetting*. Addison-Wesley, second edition, 2004.

2.2.2 Indexing

An index for the document can be generated automatically using the "makeidx" package. The command "**makeindex**" must also be used in the preamble of the document, and a command "**index**{key}" each time an index entry should be created for the provided *key*.

LaTeX then generates a `.idx` file, which is processed by the `makeindex` program to generate a `.ind` file, which is included in the document thanks to the "**printindex**" command.

Example 5 (Indexing)**.**

Contents of `example3.tex`

```
1 \documentclass{article}
2 \usepackage{makeidx}
3 \makeindex
4 \begin{document}
5 Here is an \emph{entry}\index{entry}.
6
7 \printindex
8 \end{document}
```

can be processed by

```
# pdflatex example3
# makeindex example3
# pdflatex example3
```

It will not result in anything fancy; here is rather the index of this document:

Index

3 Packages

There are many, *many* packages available for LaTeX, BibTeX and other TeX-related software (the current file index of CTAN weights more than 10MiB). LaTeX packages gather sets of macro definitions and redefine some of the LaTeX internals.

Example 6 (Loading Packages)**.** A package a loaded through a command of the form "**usepackage**[*options*]{*package*}". The command has to appear in the *preamble*, i.e. after the "**documentclass**" directive and before the beginning of the "document" environment. Here is an example that loads "babel" and "inputenc":

```
\documentclass{article}
\usepackage[francais]{babel} % French typography and hyphenation
\usepackage[latin1]{inputenc} % Allow accented chars from iso-8859-1
\begin{document}
  Une machine de \bsc{Turing} est un tuple $\mathcal{M}=\langle
  Q,\Sigma,\Gamma,\delta,q_0,F\rangle$: $Q$ est un ensemble fini
  d'états, $\Sigma$ et $\Gamma$ sont des alphabets d'entrée et de
  travail respectivement, $\delta\subseteq Q\times\Gamma\times
  Q\times\Gamma\times\{\leftarrow,\rightarrow\}$ est une relation de
  transition associant à un état courant et un symbole de l'espace
  de travail un nouvel état, un symbole de remplacement, et une
  direction de la tête de lecture, $q_0\in Q$ est un état initial,
  et $F\subseteq Q$ est un ensemble d'états finaux.

  Une configuration \dots
\end{document}
```

results in a document

> Une machine de Turing est un tuple $\mathcal{M} = \langle Q, \Sigma, \Gamma, \delta, q_0, F\rangle$: Q est un ensemble fini d'états, Σ et Γ sont des alphabets d'entrée et de travail respectivement, $\delta \subseteq Q \times \Gamma \times Q \times \Gamma \times \{\leftarrow, \rightarrow\}$ est une relation de transition associant à un état courant et un symbole de l'espace de travail un nouvel état, un symbole de remplacement, et une direction de la tête de lecture, $q_0 \in Q$ est un état initial, et $F \subseteq Q$ est un ensemble d'états finaux.
>
> Une configuration ...

Note for instance the inserted unbreakable space before the colon ":". The "**bsc**" command enforces the French usage of small-caps with no line breaks for last names.

Let us finish this document with a short overview of a few useful LaTeX packages. The purpose of the section is not to explain in details how each package can be used (read the documentation for that!), but to show a few handy ones along with examples of use.

3.1 Bibliographies

The "natbib" package is very useful for author-year references and more flexible citation commands.

Example 7. Contrast Example 4 with the following:

```
\usepackage{natbib}
...
\Citeauthor{TeX} is the inventor of \TeX, but the text processing
tool most people use in mathematics and computer science is the
higher−level \LaTeX~\citep{LaTeX}, built on top of \TeX.

An excellent reference for the management of bibliographies in
\LaTeX\ is given by \citet[Chapters~12 and~13]{latexcomp}.

\bibliographystyle{plainnat}
\bibliography{mybib}
```

which results in:

Knuth is the inventor of TeX, but the text processing tool most people use in mathematics and computer science is the higher-level LaTeX (Lamport, 1994), built on top of TeX.

An excellent reference for the management of bibliographies in LaTeX is given by Mittelbach and Goossens (2004, Chapters 12 and 13).

References

Donald E. Knuth. *The TeXbook*. Addison-Wesley, 1984.

Leslie Lamport. *LaTeX: A Document Preparation System*. Addison-Wesley, second edition, 1994.

Frank Mittelbach and Michel Goossens. *The LaTeX Companion: Tools and Techniques for Computer Typesetting*. Addison-Wesley, second edition, 2004.

Note that we used a different, "natbib"-compliant style for the bibliography, namely "plainnat" instead of "plain".

3.2 Mathematics

The main package for mathematics is $\mathcal{AMS}$-LaTeX, loaded through the package "amsmath". More packages should be loaded along with it, notably "amssymb" for additional symbols, and possibly "mathtools" for some interesting additions to $\mathcal{AMS}$-LaTeX.

Among the many features of $\mathcal{AMS}$-LaTeX, let us mention the environments for equations: "equation", "align", "gather", "multline", and their starred versions (which do not display equation numbers). Also handy are the commands "\tag" (to add text between parenthesis instead of the equation number) and "\text" (to go back to text mode inside math mode).

Theorems and other similar environments are usually defined using the "amsthm" package (a more recent but also less stable alternative is "thmtools").

Example 8. A typical declaration for theorem-like environments would be

```
\theoremstyle{break}
\newtheorem{theorem}{Theorem}
```

```
\newtheorem{lemma}{Lemma}
\newtheorem{proposition}{Proposition}
\newtheorem{corollary}{Corollary}
\theoremstyle{definition}
\newtheorem{definition}{Definition}
\newtheorem{example}{Example}
\theoremstyle{remark}
\newtheorem{remark}{Remark}
```

These newly-created environments can then be used:

```
\begin{lemma}[Context−Freeness]
  Fix a context−free grammar
  $\mathcal{G}=\langle\Sigma,N,P,S\rangle$, $V=N\uplus\Sigma$, and
  let $m\geq 1$. If $\alpha_1,\dots,\alpha_m,\beta$ are sequences
  in $V^\ast$
  s.t.\ $\alpha_1\cdots\alpha_m\Rightarrow_{\mathcal{G}}^n\beta$
  for some $n\geq 0$, then there exist $n_1,\dots,n_m$ in
  $\mathbb{N}$ and $\beta_1,\dots,\beta_m$ in $V^\ast$ s.t.\
  $n=n_1+\cdots+n_m$, $\beta=\beta_1\cdots\beta_m$, and for all
  $1\leq i\leq m$, $\alpha_i\Rightarrow^{n_i}_{\mathcal{G}}\beta_i$.
\end{lemma}
\begin{proof}
  By induction on $n$.

  For the base case $n=0$, the lemma holds when defining $n_i=0$
  and $\beta_i=\alpha_i$ for each $1\leq i\leq m$.

  For the induction step, given a derivation in $n+1$ steps, we can
  isolate a first step:
  \begin{align*}
    \alpha_1\cdots\alpha_m
    &=\alpha_1\cdots\alpha'_jA\alpha''_j\cdots\alpha_m
      \tag{by setting $\alpha_j=\alpha'_jA\alpha''_j$}\\
    &\Rightarrow_{\mathcal{G}}\alpha_1\cdots\alpha'_j\gamma\alpha''_j
     \cdots\alpha_m
     \tag{by some rule $A\rightarrow\gamma$ in $P$}\\
    &\Rightarrow^n_{\mathcal{G}}\beta\;.
  \end{align*}
  By induction hypothesis, these last $n$ steps imply the
  existence of $n'_1,\dots,n'_m$ in
  $\mathbb{N}$ and $\beta_1,\dots,\beta_m$ in $V^\ast$ s.t.\
  $n=n'_1+\cdots+n'_m$, $\beta=\beta_1\cdots\beta_m$, and for all
  $1\leq i\leq m$,
  $\alpha_i\Rightarrow^{n'_i}_{\mathcal{G}}\beta_i$; in particular,
  \begin{equation*}
    \alpha_j=\alpha'_jA\alpha''_j
    \Rightarrow_{\mathcal{G}}\alpha'_j\gamma\alpha''_j
    \Rightarrow^{n'_j}_{\mathcal{G}}\beta_j\;.
  \end{equation*}
  Then, setting $n_j=n'_j+1$ and $n_i=n'_i$ for all $i\neq j$
  proves the lemma.
\end{proof}
```

As you can see, "amsthm" also provides a "proof" environment:

Lemma 1 (Context-Freeness)**.** *Fix a context-free grammar $\mathcal{G} = \langle \Sigma, N, P, S \rangle$, $V = N \uplus \Sigma$, and let $m \geq 1$. If $\alpha_1, \ldots, \alpha_m, \beta$ are sequences in V^* s.t. $\alpha_1 \cdots \alpha_m \Rightarrow_{\mathcal{G}}^{n} \beta$ for some $n \geq 0$, then there exist $n_1, \ldots, n_m$ in $\mathbb{N}$ and $\beta_1, \ldots, \beta_m$ in V^* s.t. $n = n_1 + \cdots + n_m$, $\beta = \beta_1 \cdots \beta_m$, and for all $1 \leq i \leq m$, $\alpha_i \Rightarrow_{\mathcal{G}}^{n_i} \beta_i$.*

Proof. By induction on n.

For the base case $n = 0$, the lemma holds when defining $n_i = 0$ and $\beta_i = \alpha_i$ for each $1 \leq i \leq m$.

For the induction step, given a derivation in $n+1$ steps, we can isolate a first step that exercises some production $A \to \gamma$ in P:

$$\begin{aligned} \alpha_1 \cdots \alpha_m &= \alpha_1 \cdots \alpha'_j A \alpha''_j \cdots \alpha_m && \text{(by setting } \alpha_j = \alpha'_j A \alpha''_j\text{)} \\ &\Rightarrow_{\mathcal{G}} \alpha_1 \cdots \alpha'_j \gamma \alpha''_j \cdots \alpha_m && \text{(by some rule } A \to \gamma \text{ in } P\text{)} \\ &\Rightarrow_{\mathcal{G}}^{n} \beta\ . \end{aligned}$$

By induction hypothesis, these last n steps imply the existence of $n'_1, \ldots, n'_m$ in $\mathbb{N}$ and $\beta_1, \ldots, \beta_m$ in V^* s.t. $n = n'_1 + \cdots + n'_m$, $\beta = \beta_1 \cdots \beta_m$, and for all $1 \leq i \leq m$, $\alpha_i \Rightarrow_{\mathcal{G}}^{n'_i} \beta_i$; in particular,

$$\alpha_j = \alpha'_j A \alpha''_j \Rightarrow_{\mathcal{G}} \alpha'_j \gamma \alpha''_j \Rightarrow_{\mathcal{G}}^{n'_j} \beta_j\ .$$

Then, setting $n_j = n'_j + 1$ and $n_i = n'_i$ for all $i \neq j$ proves the lemma. □

3.3 Layout

The "geometry" package features a very comprehensive set of commands for fine-tuning the layout of your pages.

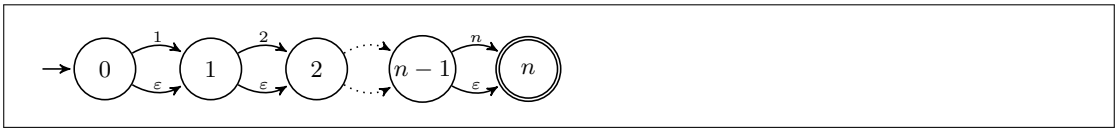
3.4 Drawing

Ti*k*Z (standing for "Ti*k*Z ist *kein* Zeichenprogram", with package name "tikz") is a highly versatile package for drawing.

Example 9 (Drawing with Ti*k*Z)**.** Let us draw an automaton with "tikz":

```
\usepackage{tikz}
\usetikzlibrary{positioning}
\usetikzlibrary{arrows}
\usetikzlibrary{automata}
...
\begin{tikzpicture}
  [->,>=stealth',shorten >=1pt,initial text=,%
  node distance=2cm,on grid,semithick,auto,
  inner sep=2pt]
  \node[state,initial](0) {0};
  \node[state] (1) [right=of 0] {1};
  \node[state] (2) [right=of 1] {2};
  \node[state] (m) [right=of 2] {$n-1$};
  \node[state,accepting] (n) [right=of m] {$n$};
  \path[every node/.style={font=\footnotesize}]
  (0) edge[bend left] node{1} (1)
```

```
  (0) edge[bend right] node{$\varepsilon$} (1)
  (1) edge[bend left] node{2} (2)
  (1) edge[bend right] node{$\varepsilon$} (2)
  (2) edge[bend left,dotted] (m)
  (2) edge[bend right,dotted] (m)
  (m) edge[bend left] node{$n$} (n)
  (m) edge[bend right] node{$\varepsilon$} (n);
\end{tikzpicture}
```

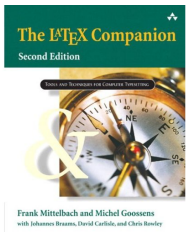


3.5 Graphics

Use the "graphics" package for loading external images into your document. Whenever possible, use *vector graphics*: except at very high resolutions (and then the size of your document blows up), bitmaps have a very poor rendering when printed.

Example 10.

```
\includegraphics[height=3cm]{tlc2e.jpg}
```



(As you can see from the "`.jpg`" extension, this is an instance of the "do as I say, not as I do" principle.)

3.6 Source Code

The "listings" package provides an extensive support for pretty-printing source code in a number of languages (this is what I used throughout this document).

3.7 References and Hyperlinks

The "url" package provides an "**url**{address}" command for printing URLs. The "hyperref" package redefines much of LaTeX internals in order to benefit from some of the capabilities of the PDF format: hyperlinks within the document, a navigation table, meta-information, etc.