A Document Preparation System

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Outline

1. Introduction
2. \LaTeX{} command syntax
3. Basic \LaTeX{} document layout
4. Bibliography
5. \LaTeX{} installation
6. Stellenbosch
7. Links
**What is \TeX?**

\TeX is a typesetting system written by Donald E. Knuth, who says in the Preface to his book on \TeX that it is “intended for the creation of beautiful books — and especially for books that contain a lot of mathematics.”

\TeX is a macro processor, and offers its users a powerful programming capability. \TeX on its own is a pretty difficult beast to deal with, so Knuth provided a package of macros for use with \TeX called Plain \TeX;

\[
\frac{\partial \rho}{\partial t} = \text{div}(\rho \vec{v})
\]

\[
\rho \frac{D \vec{v}}{Dt} = \rho \vec{g} + \frac{\partial}{\partial x_j} \left[ \mu \left( \frac{\partial v_i}{\partial x_j} + \frac{\partial v_j}{\partial x_i} \right) + \delta_{ij} \lambda \text{div} \vec{v} \right]
\]

\[
\rho \frac{D e}{Dt} = \text{div}(k \nabla T)
\]
What is **\LaTeX**?

- **\LaTeX** is a **\TeX** macro package, originally written by Leslie Lamport, that provides a document processing system. **\LaTeX** allows markup to describe the structure of a document, so that the user need not think about presentation. By using document classes and add-on packages, the same document can be produced in a variety of different layouts.

- **\LaTeX** is for producing scientific and mathematical documents of high typographical quality and is also suitable for producing all sorts of other documents, from simple letters to complete books.

- **\LaTeX** is *not* a word processor! Instead, **\LaTeX** encourages authors not to worry too much about the appearance of their documents but to concentrate on getting the right content.
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**Introduction**
- What is \TeX and \LaTeX?
- WYSIWYG vs Markup
- Why use \LaTeX?

**Syntax**
- Classes
- \LaTeX packages
- Main document
- Headings
- Paragraph text
- Math
- Cross references
- Lists
- Tables and figures

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**\LaTeX vs MS Word**

A graph comparing the effort and time consumption of \LaTeX and MS Word as the document complexity and size increase. The graph shows that while MS Word becomes impractical for complex documents, \LaTeX remains manageable.
WYSIWYG vs Markup languages

**Word processors (WYSIWYG)**
- Microsoft Word, Open Office, etc.
- Have a WYSIWYG interface hiding the markup.
- They’re perceived to be easier than \LaTeX, but ... 

**Markup languages**
- Written in normal text with markup in a text editor.
- Needs to be interpreted or compiled (programming language)
  - HTML
  - \LaTeX
- Contents separated from format; uses style sheets to change appearance.

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**HTML Example**

```html
<html>
  <head>
    <title>HTML Example</title>
  </head>
  <body>
    <p><b>Hello</b> world</p>
  </body>
</html>
```

**Output**

![HTML Example - Microsoft Internet Explorer](image)
LaTeX Example

\documentclass{article}
\begin{document}
If $f(x)=3x+7$ and $g(x)=x+4$ then
\begin{equation}
    f(x) + g(x) = 4x + 11
\end{equation}
and
\begin{equation}
    f(x)g(x) = 3x^2 + 19x + 28.
\end{equation}
\end{document}

Output

If \( f(x) = 3x + 7 \) and \( g(x) = x + 4 \) then
\[
    f(x) + g(x) = 4x + 11 \tag{1}
\]
and
\[
    f(x)g(x) = 3x^2 + 19x + 28. \tag{2}
\]
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Why use \LaTeX? 

- Very high quality documents.
- The most sophisticated math typesetting engine available.
- Sophisticated page, paragraph and line breaks with hyphenation.
- Micro typographical ligatures, letters spacing, hanging punctuation, etc.
- Floating figures for optimal page layout with graphics and tables.
- Easy cross referencing of equations, figures, etc. with hyperref links.
- Powerful linkage to bibliography databases, citing mechanisms and bibliography formatting.
- Automatic tables of contents.
- Automatic language settings.

*Did I mentioned very high quality documents.*
### Micro typesetting

<table>
<thead>
<tr>
<th>Kerning</th>
<th>✔</th>
<th>✗</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table, Avant</strong></td>
<td></td>
<td><strong>Table, Avant</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ligatures</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fire, office</td>
<td></td>
<td>fire, office</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Letterspace</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Danie</td>
<td></td>
<td>Danie</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>True small caps</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPE TOWN</td>
<td></td>
<td>CAPE TOWN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hanging Punct</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>understand anything. So much so that those who saw him exclaimed: “What a burden he’ll be to his father!” Now when there was anything to be done, the eldest had</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Active chars**

- # $ % ^ & _ { } \ - escape char to activate commands
- \ - activate math
- $ - activate math
- % - comment char

**Special chars**

- \"{e}, {\O} - gives ë, Ø

**Inline commands**

- \( \text{rmfamily}, \ \text{itshape}, \text{etc.} \)

**Macros**

- \text{section}\{Syntax\} - cmd with argument
- \text{func}[x]\{\cos\} - cmd with optional arg

**Environments**

- \text{begin}\{itemize\}
- \text{item} ... 
- \text{end}\{itemize\}
\documentclass[a4paper,12pt]{article}

% Preamble -------------------------------
\usepackage{amsmath}

% Beginning of main document -------
\begin{document}

\section{Functions}% Heading -----

In equation (\ref{eq:a}) the quadratic function of $x$ is shown as
\begin{equation}
  f(x) = ax^2 + bx + c
\end{equation}
\label{eq:a}
\begin{equation}
  \text{It can be shown that } x \geq \sqrt{\alpha} \text{ and ...}
\end{equation}
\end{document}
1. Functions

In equation (1) the quadratic function of $x$ is shown as

$$f(x) = ax^2 + bx + c$$

(1)

It can be shown that $x \geq \sqrt{a}$ and ...
\documentclass[a4paper,12pt]{article}

Specify the basic formatting of the document: Type block, headers, title page, paragraph indents and spacing, etc. Optional settings for paper size, font size, etc.

- **article, report, book**: Standard LaTeX classes
- **memoir, koma**: Other useful specialized classes
- **amsart, elsivier, etc.**: Journal classes
- **usthesis**: Stellenbosch thesis class
There are hundreds of different packages available on CTAN for any thing you can think of. Some useful packages for theses are:

- **amsmath**: Advanced mathematical typesetting
- **hyperref**: Hyper links in PDF documents
- **graphicx**: Inclusion of graphics
- **array**: For tables and arrays
- **siunitx**: Type setting of units and numbers
- **fourier**: A very nice complete font set
Main document

\begin{document}
....
\end{document}

This is the main contents of the document.

Headsings

\section{Functions}

\LaTeX{} has a hierarchy of headings

- \part
- \chapter
- \section, \subsection, \subsubsection
- \paragraph, \subparagraph
In equation (\ref{eq:a}) the quadratic function of $x$ is shown.

This is a new paragraph.

A new paragraph is terminated by an open line in the text.

\begin{equation}
    f(x)=ax^2 + bx + c
\end{equation}

Math
defines the quadratic function of $x$.

Mathematics can be written inline as $x=3$ or as display math as in example above.

The AMS math package gives a wealth of different ways to format difficult equations and please RTFM!
Cross references

In equation (\ref{eq:a}) the quadratic function of $x$ is shown
\begin{equation}
f(x)=ax^2 + bx + c
\end{equation}
\label{eq:a}

Output

In equation (1) the quadratic function of $x$ is shown

\[ f(x) = ax^2 + bx + c \] (1)

The $\LaTeX$ \texttt{\label{...}} and \texttt{\ref{...}} commands provide a very powerful way to cross ref all the sectioning levels, equations, figures and tables, etc.
Lists

**Enumerate:**
\begin{enumerate}
  \item The first item
  \item The second item
\end{enumerate}

**Output**
1. The first item
2. The second item

**Itemize:**
\begin{itemize}
  \item The first item
  \item The second item
\end{itemize}

**Output**
- The first item
- The second item

**Description:**
\begin{description}
  \item[First] item
  \item[Second] item
\end{description}

**Output**
First item
Second item
Figures can be included from external files (or generated inside \LaTeX). They float to where \LaTeX find it best.

- **\LaTeX**: PostScript
- **PDF\LaTeX**: PDF, PNG, JPEG, MPOST
Tables
\begin{table}
\begin{tabular}{l*{6}{c}r}
\hline
Team & P & W & D & L & F & A & Pts \\
\hline
Manchester United & 6 & 4 & 0 & 2 & 10 & 5 & 12 \\
Celtic & 6 & 3 & 0 & 3 & 8 & 9 & 9 \\
Benfica & 6 & 2 & 1 & 3 & 7 & 8 & 7 \\
\hline
\end{tabular}
\end{table}

Output

<table>
<thead>
<tr>
<th>Team</th>
<th>P</th>
<th>W</th>
<th>D</th>
<th>L</th>
<th>F</th>
<th>A</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchester United</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Celtic</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Benfica</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>
The Bib\TeX\xspace companion program makes it possible to link a bibliographic database direct into a \LaTeX\xspace document.

### Bib\TeX\xspace data item

```
@ARTICLE{Ciamarra-2005,
    author = {Ciamarra, M. and Coniglio, A. and Nicodemi, M.},
    title = {Shear instabilities in granular mixtures},
    journal = {Physical Review Letters},
    year = {2005},
    volume = {94},
    number = {18},
    pages = {18 -- 24})
```

### In text

\cite{Ciamarra-2005} \rightarrow Ciamarra et al. (2005)

### List of references:

For a proper working \LaTeX{} installation you need the following:

1. A \LaTeX{} system with programs and packages.
2. A \LaTeX{} text editor (IDE)
3. A Bib\LaTeX{} bibliography database manager
The \LaTeX{} distributions provide comprehensive \TeX/\LaTeX{} systems with binaries for Linux, Windows and Apple Mac OS X. It includes all the major \TeX-related programs, macro packages, and fonts, including support for many languages around the world.
Texmaker a free LaTeX editor

It is suitable for beginners as a first step with a lot of examples, and it is also suitable for experienced TeX users who are interested in details about \LaTeX\ programming. However, it is neither a complete reference, nor a complete manual of \TeX\.

## 1 Introduction

This document is intended to provide a direct start with \TeX\ programming (not necessarily \LaTeX\ typesetting). The addressed audience consists of people interested in package or binary writing.

The aim of this tutorial is to provide a short and concrete introduction to \TeX\ programming. It might be a good starting point for interested readers. Consult the literature given below for more details.

### 2.1 Variables in \TeX\

\TeX\ provides several different variables and associated registers which can be manipulated freely.
JabRef bibliography reference manager
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\textbf{USThesis} Class/style files to typeset reports, theses and dissertations that conform to the requirements of Stellenbosch University.

\textbf{USbib} A Bib\TeX package for the formatting of bibliographic references of theses.

\textbf{USTitle} A package that redefine the title page to add a logo at the top and an address line below the author.

\textbf{USnomencl} Simple utility to set a nomenclature or list of symbols.

\textbf{USsummary} Summary page required for the final year projects of the M&M Department.

\textbf{USlogos} A collection of Stellenbosch University crest and logos and Engineering logos.

These packages are all part of the standard \TeX Live and MiK\TeX distribution. Do not use old versions!
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This document & LaTeX install

For more information on LaTeX:
http://latex-project.org
http://latex-project.org/guides
http://www.tug.org
http://www.tug.org/interest.html
http://www.ctan.org

Tutorials & wikis
http://www.ctan.org/pkg/lshort-english
http://en.wikibooks.org/wiki/LaTeX
http://www.andy-roberts.net/writing/latex
http://latex.silmaril.ie/formattinginformation
http://tug.org/tutorials/tugindia
http://csweb.ucc.ie/~dongen/LAF/LAF.html
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Any \LaTeX questions?