Everything You Wanted to Know About LaTeX, But Were Afraid to Ask

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Outline

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LaTeX is a Document Typesetter

- A typesetter produces well-designed books or articles intended to be read.
- LaTeX takes raw text (a text file) and typesets it (the output file).

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Platform Windows, Unix/Linux, Mac, ...

Quality Camera-ready output

Extendable Customizable for any project

Flexible Produces output as PS, pdf, html, ...

Free The most stable open source software

Microsoft Word Versus LaTeX

WYSIWYG Versus WYSIWYW

Kerning In Word: Table In LaTeX: Table

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Ligatures In Word: fire flower

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In LaTeX: AAa AB BC CD

Hyphenation Automatic at line breaks between syllables

- Graphics taken from the essay "The Beauty of LaTeX" by Dario Taraborelli, `http://nitens.org/taraborelli/latex`

Outline

From Mark-Up to Output

From Plain Text to Professional Text!

```
\documentclass[11pt]{article}
\title{Laden and Unladen Swallows}
\author{M.\ Python, B.S.}

\begin{document}
\maketitle

\section{Introduction}
In this paper, we examine the puzzle of the
laden versus the unladen swallow. It is
known that the unladen swallow will travel
faster than the laden swallow, unless the
laden swallow is carrying more than five
coconuts. Both Henri Poincar\'e and Paul
Erd\H{o}s agree \ldots
```

Laden and Unladen Swallows

M. Python, B.S.

October 14, 2015

1 Introduction

In this paper, we examine the puzzle of the laden versus the unladen swallow. It is known that the unladen swallow will travel faster than the laden swallow, unless the laden swallow is carrying more than five coconuts. Both Henri Poincaré and Paul Erdős agree ...

The LaTeX Workflow

1. Plain text file (`myfile.tex`)
2. Process the text file (`latex myfile.tex`)
3. Generate the output (`myfile.dvi`)
4. Convert it (`myfile.pdf`, `myfile.ps`, whatever)
   If okay, continue; otherwise go to step 1
5. Print, publish, post

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The Brief LaTeX History

- 1978, Donald Knuth created TeX and METAFONT
- 1985, Leslie Lamport created macro add-ons (hence called "LaTeX" for "Lamport's TeX")
- 1989, TeX and METAFONT frozen
- 1990, AMS released $\mathcal{AMS}$-TeX, and later, $\mathcal{AMS}$-LaTeX
- Current version is LaTeX 2ε

An Example of Stability

- Walter Gander wrote the first book in LaTeX: *Computermathematik*, in 1985
- Out of print, rights reverted to him in 2008
- Processed his original 1985 files and it is now on the web, exactly as it was in 1985: `https://www.inf.ethz.ch/personal/gander/`

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- Processed his original 1985 files and it is now on the web, exactly as it was in 1985: `https://www.inf.ethz.ch/personal/gander/`
- Can you imagine a 30-year old Word document to be as stable?

The LaTeX Philosophy

- Content and presentation are separate
- Author should focus on content
- Layout and presentation determined by the software
- Good typesetting makes the content easy to read and is itself invisible

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What is LaTeX?
- Typesetting, Not Processing
- How Does It Work?
- History and Philosophy

What's So Great About LaTeX?
- Classes, Styles, Fonts
- Labeling and References
- Mathematics Typesetting
- Extending LaTeX
- Graphics
- Citations

So Why Should I Use LaTeX?
- Top 8 Reasons To Use LaTeX
- Obtaining LaTeX

Classes

The Overall Design Format.

- Article
- Book
- Report

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The Overall Design Format.

- Article
- Book
- Report
- Memoir, exam, amsbook, cv, etc.

Font Families and Styles

- Font families
  - Roman: Knights of the Round Table (serif)
  - Sans-serif: Knights of the Round Table
  - `Monospaced: Knights of the Round Table` (fixed width or “typewriter”)

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- Font styles
  - *Italics: Knights of the Round Table*
  - *Slanted: Knights of the Round Table*
  - SMALL CAPS: KNIGHTS OF THE ROUND TABLE
  - **Bold: Knights of the Round Table**

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1 The Physics of Swallows

We give the introductory physics of small birds in this section. In Section 2 we focus on laden swallows.

2 The Laden Swallow

As promised in Section 1, we give results concerning laden swallows. The basic result is

$$V_l = \frac{V_s}{gc}. \tag{1}$$

In equation 1, c represents the number of coconuts.

Labeling and References

Easy to Use and Automatically Generated.

```
\section{The Physics of Swallows}\label{phys}

We give the introductory physics of small
birds in this section.  In Section
\ref{laden} we focus on laden swallows.

\section{The Laden Swallow}\label{laden}

As promised in Section \ref{phys}, we give
results concerning laden swallows.  The
basic result is
\begin{equation}\label{ladeneq}
   V_l = \frac{V_s}{gc}. \end{equation}
In equation \ref{ladeneq}, $c$ represents
the number of coconuts.
```

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Mathematics

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$$\int_2^3 x^2\ dx = \frac{19}{3}.$$

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  `\[\int_2^3 x^2\ dx=\frac{19}{3}\]`.
- Let's look at a more intense example...

Mathematics

Example 1. *Evaluate* $\iint_S \mathbf{F} \cdot \mathbf{n}\, d\sigma$ *if* $\mathbf{F} = (x^3 + \sin z)\mathbf{i} + (x^2 y + \cos z)\mathbf{j} + e^{x^2+y^2}\mathbf{k}$ *and* S *is the surface of the region bounded by* $z = 4 - x^2$, $y + z = 5$, *and* $z = y = 0$.

Solution. By the Divergence Theorem, we have

$$\begin{aligned}
\iiint_R (3x^2 + x^2 + 0)\, dx\, dy\, dz &= \iiint_R 4x^2\, dx\, dy\, dz \\
&= \int_{-2}^{2} \int_{0}^{4-x^2} \int_{0}^{5-z} 4x^2\, dy\, dz\, dx \\
&= \int_{-2}^{2} \int_{0}^{4-x^2} 4x^2(5 - z)\, dz\, dx \\
&= \int_{-2}^{2} (20x^2 z - 2x^2 z^2)\Big|_0^{4-x^2} dx \\
&= \int_{-2}^{2} (48x^2 - 4x^4 - 2x^6)\, dx = \tfrac{4608}{35}. \qquad \square
\end{aligned}$$

Mathematics

```
\begin{ex}
 Evaluate
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\end{ex}
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Example 1. *Evaluate* $\iint_S \mathbf{F} \cdot \mathbf{n}\, d\sigma$ *if* $\mathbf{F} = (x^3 + \sin z)\mathbf{i} + (x^2y + \cos z)\mathbf{j} + e^{x^2+y^2}\mathbf{k}$ *and* S *is the surface of the region bounded by* $z = 4 - x^2$, $y + z = 5$, *and* $z = y = 0$.

Solution. By the Divergence Theorem, we have

$$\begin{aligned}\iiint_R (3x^2 + x^2 + 0)\, dx\, dy\, dz &= \iiint_R 4x^2\, dx\, dy\, dz \\ &= \int_{-2}^{2} \int_{0}^{4-x^2} \int_{0}^{5-z} 4x^2\, dy\, dz\, dx \\ &= \int_{-2}^{2} \int_{0}^{4-x^2} 4x^2(5 - z)\, dz\, dx\end{aligned}$$

Mathematics

```
\begin{proof}[Solution.]
By the Divergence Theorem, we have
 \begin{align*}
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 &= \int_{-2}^2 \left.(20x^2z-2x^2z^2)
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 &= \int_{-2}^2 (48x^2-4x^4-2x^6)\ dx
  = \tfrac{4608}{35}. \qedhere
 \end{align*}
\end{proof}
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Packages and Commands

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- Fonts: `\usepackage{times}`
- AMS packages extend math symbols and theorem styles: `\usepackage{amsmath, amsthm}`
- Environments: `\usepackage{multicol}`

Packages and Commands

Command macros may be defined by the user – Ultimate customization!

- Defines an “example” environment:
  ```
  \theoremstyle{plain}
  \newtheorem{ex}{Example}
  ```
- Define a “vector” formatting:
  ```
  \newcommand{\vect}[1]{\mathbf{#1}}
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\newcommand{\vect}[1]{\vec{#1}}
```
- Define the i-j-k vector form:
```
\newcommand{\vijk}[3]
{#1\vect{i} #2\vect{j} #3\vect{k}}
```

Symbols

- All Greek letters
- Virtually every math symbol
- Called by name, i.e., `$\pi$` produces π, `$\forall$` produces $\forall$, `$\pm$` produces $\pm$

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$$\cong \sim \approx \triangle \mathbb{R} \Sigma \Pi \pi \propto \neq \leq \equiv \lambda \delta$$

$$\heartsuit \overline{AB} \rho \psi \Psi \Omega \forall \exists \cup \cap \wedge \clubsuit \oint \partial$$

$$\sigma \varsigma \Longrightarrow \mathbb{Z} \oplus \div \| \pm \perp \supseteq \nabla \longmapsto$$

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Graphics and Pictures

- Use any program you like to create your graphics, and save it as
  - `.eps` if PostScript is the output
  - `.pdf, .jpg, .png` if pdf is the output
- Put `\usepackage{graphicx}` in your `.tex` file
- `\includegraphics[`*options*`]{name_of_file}`

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- Put `\usepackage{graphicx}` in your `.tex` file
- `\includegraphics[`*options*`]{name_of_file}`
- Using the `figure` environment "floats" the graphic and provides a `\caption` command
- Tables have a similar environment

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Bibliographies

Automatic reference lists

- BibTeX is a textfile of reference data saved as `myfile.bib`
- Bibliographies automatically generated by using `\bibliographystyle{`*style name*`}` `\bibliography{myfile}`
- Citation and reference list style is customizable: APA, Chicago, AMS, Law, etc.

Sample BibTeX Entry

```
@ARTICLE{python,
   author={Monty Python},
   title={Laden and unladen swallows},
   journal={Grail Monthly},
   volume=20,
   number=3,
   month={June},
   year=1975}

The author M.\ Python \cite{python} stipulates
that coconuts are the only factor in the velocity
of laden swallows \ldots
```

Bibliographic Sample, Plain

1 Plain Style

The author M. Python [1] stipulates that coconuts are the only factor in the velocity of laden swallows ...

References

[1] Monty Python. Laden and unladen swallows. *Grail Monthly*, 20(3), June 1975.

Bibliographic Sample, APA

1 APA Style

The author M. Python (Python, 1975) stipulates that coconuts are the only factor in the velocity of laden swallows ...

References

Python, M. (1975, June). Laden and unladen swallows. *Grail Monthly*, *20*(3).

Indexing

```
We give results concerning laden swallows.
\index{swallow!laden} The basic result is
\begin{equation}\label{ladeneq}
   V_l = \frac{V_s}{gc}.
\end{equation}
In equation \ref{ladeneq}, $c$
representsthe number of
coconuts.\index{coconuts!number of}
```

The \index command automatically puts the entries *coconuts, number of* and *swallow, laden* in the index in alphabetical order with the corresponding page numbers. The \makeindex command gathers the entries, and \printindex typesets the index.

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Top 8 Reasons To Use LaTeX

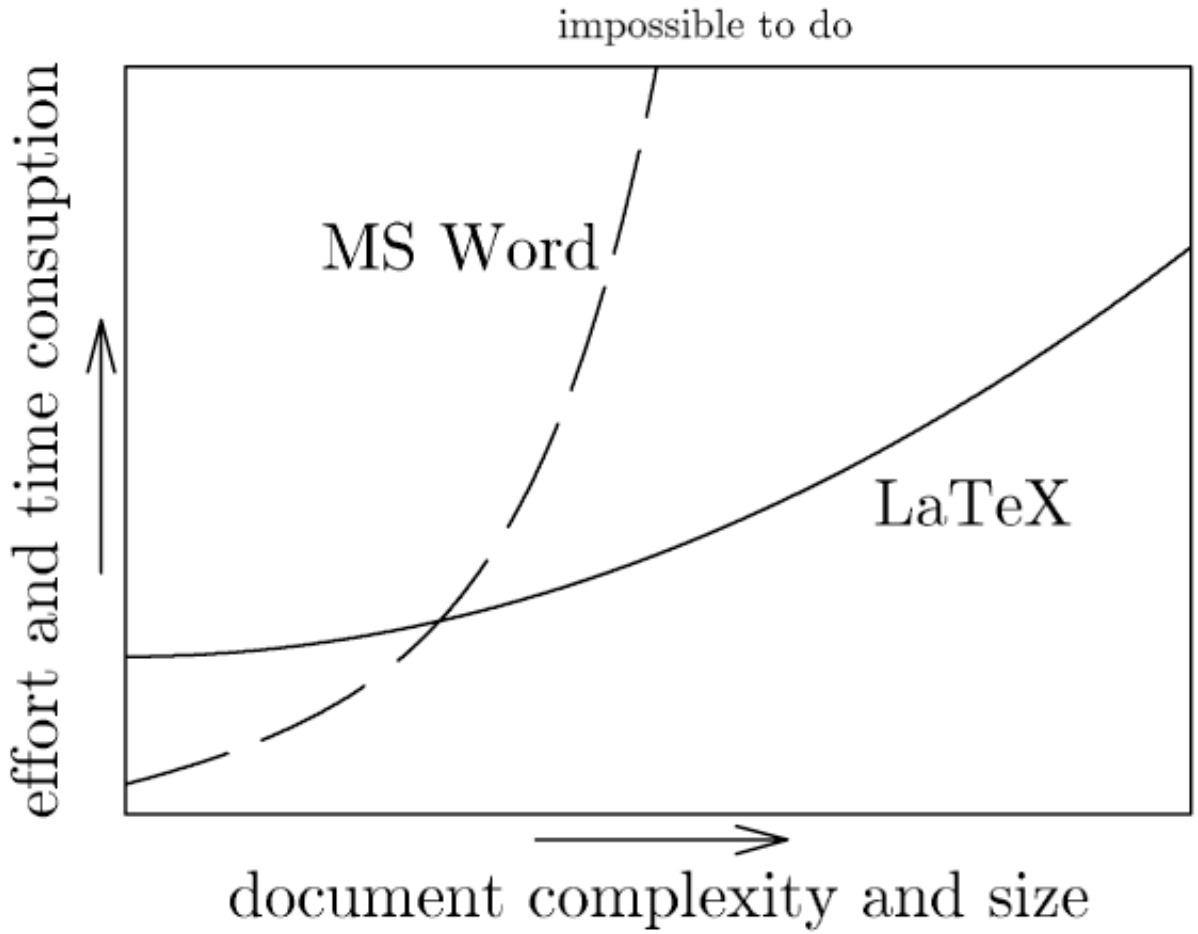

Image by Marko Pinteric, www.pinteric.com/miktex.html.

So Why Should I Use LaTeX?

1. Cross-platform encourages collaboration

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7. Available for iPad, runs from a USB, . . .
8. Free!

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Where Can I Get LaTeX?

Windows The MikTeX 2.9.5105 distribution with the TeXnicCenter 2.02 editor or the TeXworks 0.4.6 editor, `www.miktex.org` (163 MB)

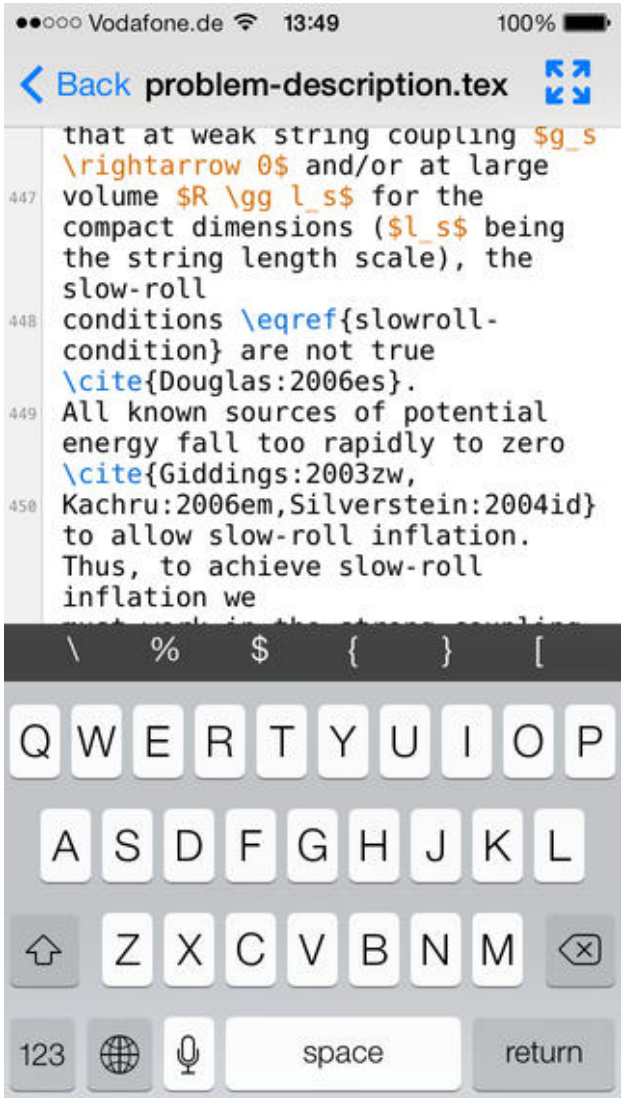
Mac The MacTeX 2015 distribution with the TeXShop 3.52 editor or the TeXworks 0.4.6 editor, `www.tug.org/mactex` (2.5 GB)

Linux MikTeX 2.9.5105 with Kile for KDE, `kile.sourceforge.net` (Kile: 16 MB)

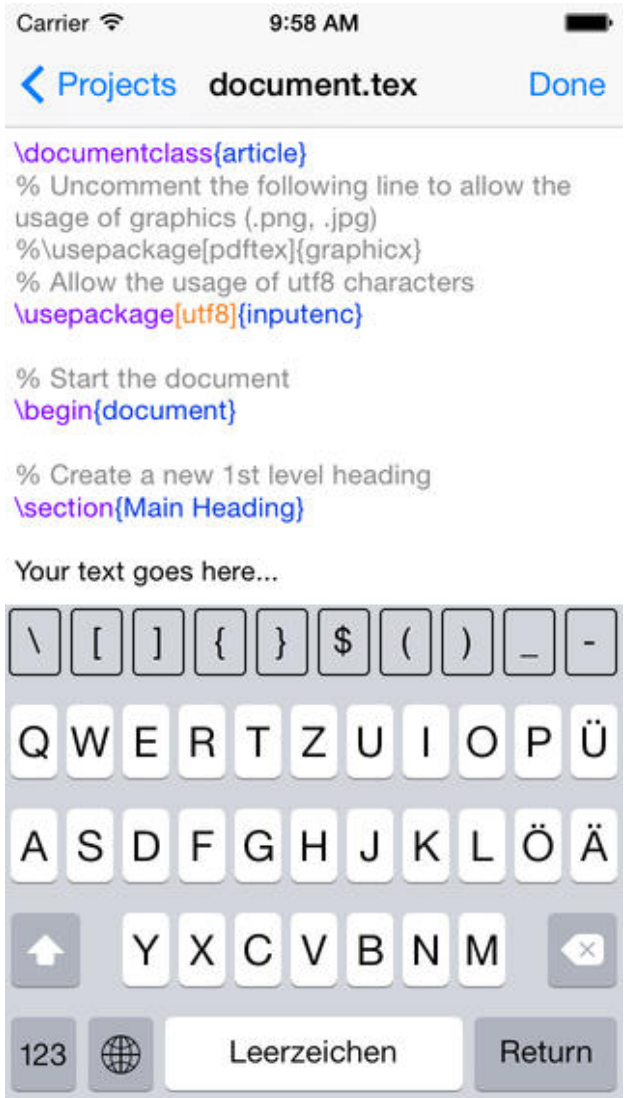
iOS For iPad, iPhone, iPodTouch in the AppStore...

iPhone Screenshots

TEXpad ($)



VerbTEX (free)



For Further Information

- Leslie Lamport.
  LaTeX, a Document Typesetting System.
  Addison-Wesley, 1994.
- Tobias Oetiker, et al.
  The Not So Short Introduction to LaTeX 2ε (Or LaTeX 2ε in 157 Minutes), Version 5.05.
  http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf
- Frank Mittelbach, et al
  The LaTeX Companion, 2nd edition.
  Addison-Wesley, 2004.
- http://www.ctan.org and http://www.tug.org
  The Comprehensive TeX Archive Network
  The TeX Users Group

Thank you!

This presentation, with active hyperlinks, is posted at

`http://www.drchuckgarner.com`

(Click on “Presentations” at the top)