A Brief Introduction to LaTeX

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What are TeX and LaTeX?

- LaTeX is a typesetting system suitable for producing scientific and mathematical documents.
  - —LaTeX enables authors to typeset and print their work at the highest typographical quality.
  - —LaTeX is pronounced "Lay-tech".
  - —LaTeX uses TeX formatter as its typesetting engine.

- TeX is a program written by Donald Knuth for typesetting text and mathematical formulas.

Why LaTeX ?

- Easy to use, especially for typing mathematical formulae

- Portability (Windows, Unix, Mac)

- Stability and interchangeability

Why LaTeX ?   contd...

- High quality

- Most journals have their LaTeX styles.

- you will be forced to use it, since everyone else around you is using it.

Why LaTeX ?   contd...

- Documentation and forums

- A universal acceptance among researchers

- Error finding and troubleshooting are not difficult.

References for LaTeX

—The not so short introduction to LaTeX2e
- http://tobi.oetiker.ch/lshort/lshort.pdf

—Comprehensive TeX archive network
- http://www.ctan.org/

—Beginning LaTeX
- http://www.cs.cornell.edu/Info/Misc/LaTeX-Tutorial/LaTeX-Home.html

—Google! !

….Leslie Lamport

…..H. Kopka

Basic File Extensions in LaTeX

File Extensions	Significance
.tex	Contains symbols and text written in the editor
.aux	Data file for cross referencing and across compilers
.log	Compiler information, warnings, error messages
.dvi	Main output file of initial TeX, same across systems
.ps	Postscript files
.cls	Class file containing commands, environments
.sty	Style file containing macro definitions, other extensions
.pdf	Common output format: Portability
.bib	Bibliography entries

How to Setup LaTeX for Windows

Download and install MikTeX
http://www.miktex.org/ ← LaTeX package

Install Ghostscript and Gsview
http://pages.cs.wisc.edu/~ghost/

← PS device driver …

Install Acrobat Reader

Install Editor
—WinEdt
http://www.winedt.com/
—TexnicCenter
http://www.texniccenter.org/
—Emacs, vi, etc.

For MAC Users

TeXShop
iTexMac
Texmaker

…

Creating a Document Using LaTeX

TeX input file
file.tex

← Source LaTeX
document

Run LaTeX
program

DVI file
file.dvi

← Device independent
output

Run Device
Driver

Output file
file.ps or file.pdf

Unix Commands

```
> latex file.tex        runs latex
> xdvi file.dvi         previewer
> dvipdf file.dvi       creates .pdf
> pdflatex file.tex     creates .pdf directly
```
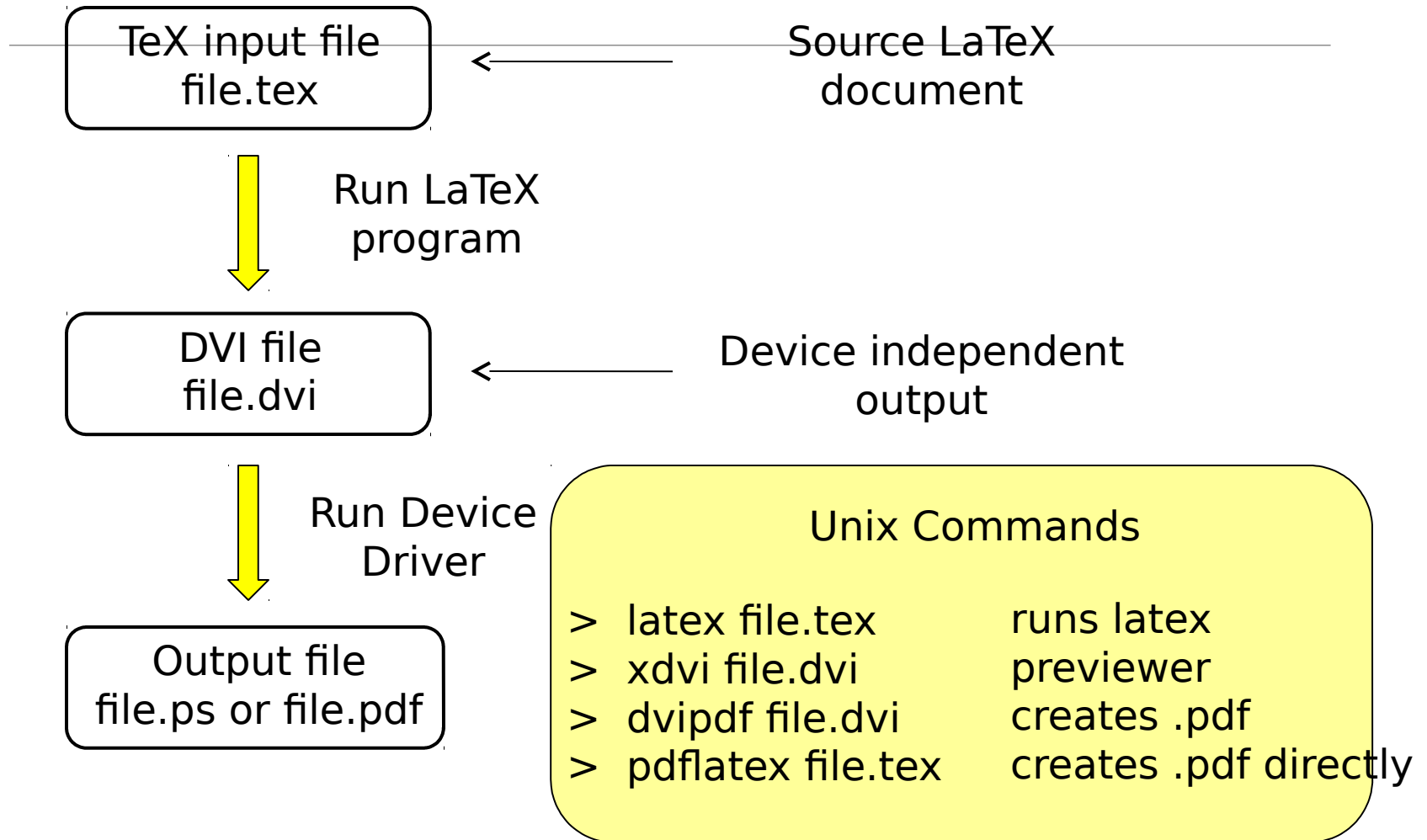
Creating a Document Using LaTeX

- Start with a skeletal document (create it, get it from classmates, download it from journals' website….).

- Fill (text, formula, figure, table, text …) the document.

- Run LaTeX to generate output and make modifications.

- Learn as you move. Code. Write.

LaTeX Document: Some Tips

- Use the tools for text formatting as need be : \paragraph, \setlength, \linespread.

- Commands start with '\'; spaces are allocated by the engine for '\\', ',\' commands. Any in-text mathematical expression is embedded in '$ $' sign.

- '%' is used for commenting and ignorable text.

- Commands take values called arguments: \command{argument} [value]. Varies the extent of the command with varying argument.

LaTeX Document: Some Useful Facts

☐ The preamble of the document contains all the necessary information for a fixed document type and code execution.

❏ \documentclass, \userpackage, \newcommand, etc.

❏ global declarations applicable to a particular document

❏ External files: class files

❏ text and content type

✂ LaTeX builds up its pages by pushing around boxes: \mbox, \parbox, \fbox , etc.

✂ Commands and texts enter together in ASCII file.

✂ Different text fonts (**\it, \bf, \rm, \sl** etc.)

Basic Structure of LaTeX Document

\documentclass [12pt]{article}

Define the types of the document (article, book, thesis ...)

\usepackage {color}
\usepackage {graphicx}

Preamble. Incorporate packages or define macros here

\begin{document}

Main body, stuff to be printed, title, authors, abstract, sections, references, ...

\end{document}

Title/Author Information and Document Structure

\begin{document}

\title {A Very Simple Introduction to LaTeX}

\author {names}

\thanks{AMS UCSC}
 …
\maketitle

…

\section{Introduction}

\subsection{Subsection Heading Here}

\end{document}

Writing a Document in Latex

Example.tex

% This is an example.tex

\documentclass {article}

\begin {document}

This is a test

\end {document}

Writing a Document in Latex

Section and subsection

Example.tex

```
% This is an example.tex

\documentclass [12pt]{article}
\begin {document}
\title {This is an example}
\author {James Bond}
\maketitle


\section {Introduction}
\subsection {Experiment}


\end {document}
```

(1) latex Example.tex   Example.dvi   (2) dvips Example.dvi   Example.ps

(3) ps2pdf Example.ps   Example.pdf

Online Library: LaTeX Symbols

—https://tex.stackexchange.com/   (Discussion forum)

—https://en.wikipedia.org/wiki/Wikipedia:LaTeX_symbols

—http://latex.wikia.com/wiki/List_of_LaTeX_symbols

—https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols

—http://www.ctan.org/

—http://artofproblemsolving.com/wiki/index.php?title=LaTeX:Symbols

How to Input Math Formulas

- Use \(… \) for in-line and \[… \] for displaying math formulas.

- Spaces inside \(… \) and \[… \] are ignored. If needed, use '\' to add space.

- Use \mbox{…} for words inside math formulas.

Standard Environments: Theorem; Equation. Etc.

\begin{env_name}
  detail
\end{env_name}

Environment name (env_name) can be document, itemize, enumerate, tabular, etc.

\begin{itemize}
    \item The first item
    \item The second item
\end{itemize}

\begin{enumerate}
    \item The first item
    \item The second item
\end{enumerate}

Cross Referencing

LaTeX generates numbers for Theorem, Equation, Section, Figure and other environments automatically. Access them with \label and \ref

\section{Introduction} \label{sec:intro}

....

In Section \ref{sec:intro}

Writing a Document in Latex

\userpackages   \newcommands

Install packages on the fly as need be.

Special packages are available for neat description of elegant mathematics and algorithms.

Use multicolumn for lengthy equations and install the requisite packages.

Journal class files use specific packages and provides less trouble while compilation.

LaTeX does not provide a command or environment that matches the criteria.
Output produced by existing command may not meet requirements.

Macros

\newcommand{name}[Num]{Definition}

A new definition for mod sign in the preamble:
\newcommand\norm[1]{\left\lVert#1\right\rVert}

Writing a Document in Latex

\userpackages

\usepackage{graphicx}
\usepackage{epstopdf}
\usepackage{subfigure}
\usepackage{comment}

\usepackage{amsmath}
\usepackage{amssymb}

\usepackage{algorithm2e}
\
usepackage{algorithmicx}

Images and artwork
eps – pdf conversion
Grouping of figures
Comments and margins

Mathematical symbol and environments
do

Environments for algorithms
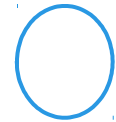
Writing a Document in Latex

Equations

Example.tex

```
\documentclass [12pt]{article}
\begin {document}
\title {This is an example}
\author {James Bond}
\maketitle
\section {Introduction}
\begin {equation}
g_{ \gamma_{n}}(t) =
\frac{1}{ \sqrt{s_{n}}}\;g(\frac{t-p_{n}}{s_{n}})\,\exp\left\{j(2\pi f_{n}t+\phi_{n})\right\},
\label {eq1}
\end {equation}
\end {document}
```

Writing a Document in Latex

Equations

Example.tex

\documentclass [12pt]{article}
\begin {document}
\title {This is an example}
\author {James Bond}
\maketitle
\section {Introduction}
\begin {equation}
g_{ \gamma_{n}}(t) =
\frac{1}{ \sqrt{s_{n}}}\;g(\frac{t-p_{n}}{s_{n}})\,\exp\left\{j(2\pi f_{n}t+\phi_{n})\right\},
\label {eq1}
\end {equation}
\end {document}

Math commands

S_n - subscript
S^n - superscript

Writing a Document in Latex

Images

Insert figures in pdf, jpg, eps, and other formats into the document.

Separate packages to handle graphics need to be installed.

```
\begin{figure}
    \centering
    \includegraphics {name of the figure file}
    \caption{Put the caption here}
\end{figure}
```

Writing a Document in Latex

Figures

```
Example.tex

% This is an example.tex

\documentclass [12pt]{article}
\usepackage {graphicx}
\begin {document}

\begin {figure}
\centering
\includegraphics[width=0.80\textwidth]
{Sistina-interno}
\caption {Sample Figure}
\label {fig1}
\end {figure}
\end {document}
```

Writing a Document in Latex

Figures

```
Example.tex

% This is an example.tex

\documentclass [12pt]{article}
\usepackage {epsfig, graphicx}
\begin {document}

\begin {figure}
\epsfxsize =6.5in
\centerline {Sistina-interno.jpg}
\end {figure}

\end {document}
```

Writing a Document in Latex

Notes on images

A float object: Latex is opportunist unless the author forces it {!htb}.

Use \subfigure package for grouping of pictures.

Exercise caution for graphics inclusion about general formatting of the text.

.jpg and .eps serve better than most.

Adhere to the artwork guideline of the journal.

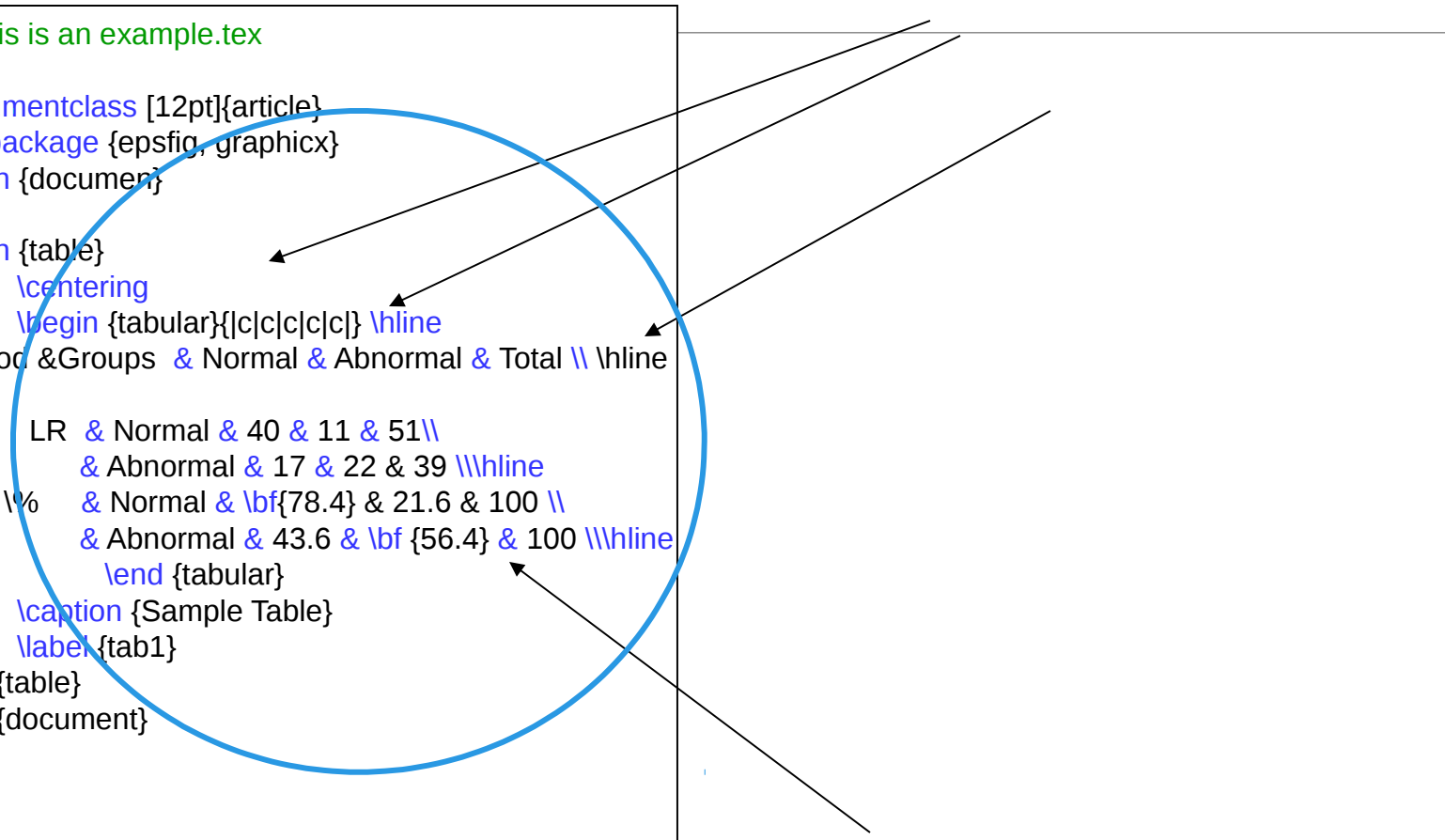# Writing a Document in Latex

Tables

Example.tex

```
% This is an example.tex

\documentclass [12pt]{article}
\usepackage {epsfig, graphicx}
\begin {document}

\begin {table}
        \centering
        \begin {tabular}{|c|c|c|c|c|} \hline
Method &Groups  & Normal & Abnormal & Total \\ \hline

     LR  & Normal & 40 & 11 & 51\\
         & Abnormal & 17 & 22 & 39 \\\hline
     \%     & Normal & \bf{78.4} & 21.6 & 100 \\
         & Abnormal & 43.6 & \bf {56.4} & 100 \\\hline
           \end {tabular}
        \caption {Sample Table}
        \label {tab1}
\end {table}
\end {document}
```

Writing a Document in Latex

References within a document

Example.tex

```
% This is an example.tex
\documentclass [12pt]{article}

\begin {document}
\section {Introduction}
\label {intro}

This is section on Introduction.

\subsection {experiment}
\label {exp}

This is an example subsection.
Please refer Section.\ref {intro} for
introduction. Refer Section \ref {exp}

\end {document}
```
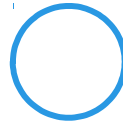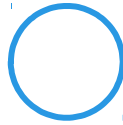
Very easy to manage all the references in long documents

Writing a Document in Latex

Citing other works

Example.tex

```
% This is an example.tex
\documentclass [12pt]{article}
\bibliographystyle {IEEEtran}
\begin {document}
\section {Introduction}
\label {intro}

This is section on Introduction.

\subsection {experiment}
\label {exp}

This is an example subsection. This
work is based on the
MP algorithm \cite {mallat2}

\bibliography {bibfile}
\end {document}
```

Order and numbering of the references are automatic

References and Citations

The \thebibliography environment produces a bibliography or reference list. In the article style, this reference list is as labeled "References"; in the report style, it is labeled as "Bibliography".

```
\begin{thebibliography} {widest-label}

\bibitem[label]{cite_key}
  . . .
\end{thebibliography}
```

widest-label: Text that, when printed, is approximately as wide as the widest item label produces by the \bibitem commands.

Reference and Citation

For 10 and 99 publications, start with \begin{thebibliography}[99]. Use any two digit number in the argument, since all numerals are of the same width.

For customized labels, put the longest label in argument, i.e., type.\begin{thebibliography}[Longest-name]

Reference and Citation

```
\begin{thebibliography} {widest-
label}

     \bibitem[label]{cite_key}
      . . .
 \end{thebibliography}
```

- cite_key is used to cite publications inside the document.

- To cite a publication from the reference list, use the \cite command.

- The argument to \cite may be one key, or two or more keys, separated by commas.

One can use the bibTeX package to generate reference list.

Example Document From an IEEE Journal

To write a paper for conferences/journals/transactions:

- Download LaTeX template from IEEE (or from the specific journal website).

http://www.ieee.org/web/publications/authors/transjnl/index.html

- Open example LaTeX file (bare_jrnl.tex) and modify it.

- No need to worry about things like margin, font, …

bare_jrnl.tex

Questions!