Use \LaTeX{}, and Get a Life

Or, Just Another Introduction to \LaTeX{}

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References

- \LaTeX{} for academics and researchers who (think they) don’t need it, Peter Flom
- 王垠, “TeX – Beauty and Fun”,
  http://www.ctex.org/documents/shredder/tex_frame.html
- Oetiker et al., *The Not So Short Introduction to LaTeX2e*,
  http://www.ctex.org/documents/shredder/tex_frame.html
- \LaTeX{} – Wikibooks http://en.wikibooks.org/wiki/LaTeX
- http://www.latex-tutorial.com/
Outline

1. Introduction
2. Basics
3. Practical pointers
4. Reality Check
Disclaimer

😊 可能不太適用於中文科學寫作
笑脸 可能不太適用於中文科學寫作

😊 Also check with your supervisor for approval (tba)
Outline

1. Introduction
2. Basics
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4. Reality Check
Coded by Two Turing Winners

- **TEX** was written by Donald E. Knuth

- **LaTeX** is a macro package based on **TEX**, written by Leslie Lamport.
Coded by Two Turing Winners

- \TeX \ was written by Donald E. Knuth
Coded by Two Turing Winners

- **\TeX** was written by Donald E. Knuth

- **\LaTeX** is a macro package based on \TeX, written by Leslie Lamport.
Philosophy of TeX

- WYTIWYG instead of WYSIWYG
- Writing should be separated from formatting
- TeX designed with two main goals in mind: to allow anybody to produce high-quality books using a reasonably minimal amount of effort, and to provide a system that would give exactly the same results on all computers, at any point in time
- Optimized font design (METAFONT and Computer Modern), spacing, line breaks and hyphenation
- Supports macros, which help extensions into LaTeX and ConTeXt
- Very stable, current version 3.14159265
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Begin, and End

- LaTeX file starts with preambles: document class and necessary packages to be used
- Followed by frontmatter (title, author, date etc.)
- Then: \begin{abstract}Abstract goes here \end{abstract}
- Then: Everything else is between \begin{document} and \end{document}
- Other environments to begin and end: equation, figure, table, algorithm,
Front matter

- title
- author

\texttt{\textbackslash{}title\{My First Paper Written in \LaTeX\\{}\}
\texttt{\textbackslash{}author\{Jeremiah Deng\}
\texttt{\textbackslash{}institute\{University of Otago, New Zealand\}
\texttt{\textbackslash{}date\{\textbackslash{}today\}
Structures

- Chapter: `\chapter{My next chapter}`
- Section: `\section{My next section}`
- `\subsection`, `\subsubsection` ...
- Each (sub)section is automatically numbered.
- You can `label` (`\label`) it and `refer` (`\ref`) to it anywhere in the document.
- Structural changes may require two rounds of compiling (also for label and bibliographical changes).
Typesetting Basics

- Font faces \textit{...} \textbf{...}
- Font sizes, from “Huge” to “normalsize” (default) to “tiny”
- Paragraphs: separated \textit{not} by line breaks but by blank lines
- Forcing line break: \\
- New page: \newpage

This means you can edit your manuscript with a plain, lightweight text editor instead of using a Word-like word processor which formats as you type, most of the time unnecessarily.

The blank line above indicates the start of a new paragraph. The only occasion that I wish for instant formatting is when little tricks are needed to save space.
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Mathematical typesetting

- $ \cdots $ inline formulas e.g., $\pi = \frac{4}{1} - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \cdots $ (Leibniz)
- $\[ \cdots \] $ is for displayed equations without numbering, e.g. Riemann’s zeta function:

$$ \frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots $$

- Formal equations:

$$ E = mc^2 \quad (1) $$

Each equation has a label and can be referred to, e.g. Eq.(1).

\begin{equation}
E=mc^2 \\
\label{eq:emc} \\
\end{equation}

Each equation has a label and can be referred to, e.g. Eq.($\ref{eq:emc}$).
All tables are numbered automatically.

Label and reference.

\begin{table}
\centering
\begin{tabular}{lrc}
Quantile & Male & Female \\
0\% & 59 & 44 \\
50\% & 69 & 64 \\
100\% & 77 & 71 \\
\end{tabular}
\caption{Quantiles of male and female heights}
\label{tab:malefemale}
\end{table}

Table: Quantiles of male and female heights
Figures

- \begin{figure} ... \end{figure}
- Treated as floats; Use “[tbph]” options to indicate location preference
- \begin{figure*} ... \end{figure*} used in double-column format for figures spanning across two columns
  - Figures may become out of order
  - Moving figures around can always solve the problem, almost ;-) 
- All figures are numbered automatically.
- Use a good vector drawing tool: LaTeXDraw, Dia, XFig, Inkscape, Visio
- Use EPS/PDF instead of raster/bitmap images for better quality
- Many plotters can output EPS: Matlab, R, gnuplot, ...
- Has subfigures? Packages ‘subfig’, ‘minipage’ etc. can help.
Citations

- BibTeX
- Types: book, bookchapter, inproceedings, article, techreport, misc,
  ......
- Automatic generation according to specified styles.
- Easy migration between styles.
- BibTeX sources available from IEEEXplore, ACM DL, DBLP, ScienceDirect, Scopus, 百度学术
Use of BibTeX

- Compose a .bib file
- Compile .tex file, then .bib file, then .tex file again 😊.

Examples:

@article{Frenkel:1987,
  author = {Frenkel, Karen A.},
  title = {Profiles in Computing: Donald E. Knuth: Scholar with a Passion for the Particular},
  journal = {Commun. ACM},
  volume = {30},
  number = {10},
  month = oct,
  year = {1987},
  pages = {816−−819},
  doi = {10.1145/30408.30412},
  publisher = {ACM},
  address = {New York, NY, USA},
}

@book{Seibel:2009,
  author = {Seibel, Peter},
  title = {Coders at Work},
  year = {2009},
  isbn = {1430219483},
  edition = {1st},
  publisher = {Apress},
  address = {Berkely, CA},
}
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Algorithm Pseudocode

Use packages ‘algorithmic’, ‘algorithm2e’, ‘algorithmicx’ etc.

```
func reverseErlangB(E, p)

Input: 0 < p < 1, E > 0
invB ← 1.0
m ← 1.0
x ← 1.0
while x > p do
    invB ← 1 + invB × m/E
    x ← 1.0/invB
    m ← m + 1
end while
return m
```

\begin{algorithmic}
\Require $0 < p < 1, E > 0$
\State \texttt{invB} $\leftarrow 1.0$
\State \texttt{m} $\leftarrow 1.0$
\State \texttt{x} $\leftarrow 1.0$
\While {\texttt{x} $> p$}
    \State \texttt{invB} $\leftarrow 1 + \texttt{invB} \times \texttt{m/E}$
    \State \texttt{x} $\leftarrow 1.0/\texttt{invB}$
    \State \texttt{m} $\leftarrow \texttt{m} + 1$
\EndWhile
\Return \texttt{m}
\end{algorithmic}
Practical pointers

`lstlisting` package supports: Java, R, Python, C/C++, Caml, Haskell, Prolog, Matlab, Mathematica, PHP, Tcl, HTML, TeX etc.

```c
#include <stdio.h>
#define N 3
/* Block
 * comment */

int main()
{
    int i;

    // Line comment.
    puts("Hello world!");
    for (i = 0; i < N; i++)
    {
        puts("You should also check out CWEB or noweb, ");
        puts("And see how to write code with a TeX doc (and why?)");
    }
    return 0;
}
```

Jeremiah Deng (Information Science)
Equations are not floats. Rather, remove unnecessary references and embed the equations in text flows. Compare:

Euler’s formula, given by Eq.(1), is very important in complex analysis.

\[ e^{i\phi} = \cos \phi + \sin \phi \]  \hspace{1cm} (1)

where the constant $e$ is the base of the natural logarithm.

Setting $\phi = \pi$ in Euler’s formula results in Euler’s identity, as shown in Eq.(2), which is celebrated by mathematicians as the most beautiful formula because it contains the five most important mathematical constants.

\[ e^{i\pi} + 1 = 0 \]  \hspace{1cm} (2)
Equations are not floats. Rather, remove unnecessary references and embed the equations in text flows. Compare:

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(1)

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\[ e^{i\pi} + 1 = 0 \]  

(2)
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Where Can I Use $\LaTeX$?

- IEEE transactions
- ACM journals
- Elsevier and Springer journals
- IEEE / ACM conferences, LNCS
  - Make sure you use the correct style file and BibTeX style
  - Clean up BibTeX entries you get from the web
  - Use `{}` to wrap around acronyms
- PhD thesis templates usually available; or adapt one for your own uni
Yet another piece of progressive work

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Yet another piece

J. D. Deng

Introduction
How to Convince Your Supervisor

- First, do not tell him 😊
  - Surprise him with the high-quality typesetting
How to Convince Your Supervisor

- First, do not tell him 😊
  - Surprise him with the high-quality typesetting
- Tell him
How to Convince Your Supervisor

- First, do not tell him 😊
  - Surprise him with the high-quality typesetting
- Tell him
- Convert him
- But we used to use “Track Changes” to revise papers... You can't say goodbye to Word?
  - Yes you can
  - For supervisors: let students learn by correcting the manuscript (not by just accepting changes)
  - Adobe Reader makes a better companion than Word
The goal of the genetic algorithm is to find the best individual (species seed) in a species. Then we delete all other individuals whose distances to the species seed are less than a threshold value called niche radius. The process is repeated until we get all the species seeds. The pseudo code of PL algorithm is shown in Algorithm 1. The final population is first sorted in a decreasing order according to their fitness values. We use $L_{\text{sorted}}$ to denote the sorted list. The input of PL algorithm includes $L_{\text{sorted}}$, $\varepsilon$, and $\phi h$, where $\varepsilon$ is a user-specified accuracy level, $\phi h$ is the niche radius, and $\phi h$ is the fitness of global optima. The algorithm maintains a solution list $S$, which is initially empty. Then it looks through the $L_{\text{sorted}}$ for an individual $\phi h$ that satisfies two conditions will be added to the solution list $S$. The first condition is that its fitness has reached the required accuracy level $\varepsilon$:

$$\phi h - \text{fit}(\phi h) \leq \varepsilon$$

The second condition is that the individual belongs to a different niche from those in $S$.

Algorithm 1 PL

Input:
$L_{\text{sorted}}$ – individuals sorted in decreasing fitness values;
$r$ – niche radius;
$\varepsilon$ – accuracy level;
$\phi h$ – the fitness of global optima;

Output:
$S$ – a set of individuals identified as solutions

1: $S \leftarrow \emptyset$;
2: while not reaching the end of $L_{\text{sorted}}$ do
3: Get the best unprocessed $p \in L_{\text{sorted}}$;
4: notNewNiche $\leftarrow$ FALSE;
5: if $\phi h - \text{fit}(p) \leq \varepsilon$ then
6: for each $s \in S$ do
7: if $||s-p||r$ then
8: notNewNiche $\leftarrow$ TRUE;
9: break;
10: end if
11: end for

It can be seen that the worst-case complexity of PL algorithm is $O(N^2)$. Generally, the total number of distance calculations will not exceed $Ns \cdot N$, where $Ns$ is the number of species in the final population. It is a much tighter upper bound of the algorithm since $Ns$ is generally much less than $N$.

C. Difficulty of Setting the Niche Radius

If all species in the final population are sufficiently converged, the identification task will become trivial. As an extreme case, suppose that individuals in the same species have converged to a single point, then we just need to delete the duplicated individuals in the final population and then we will get the answer, i.e., each individual represents a possible optimum. However, for more general cases, due to the limited budget of fitness evaluation, it is more likely that individuals in the same species are scattered around a promising region.

PL algorithm uses a parameter called niche radius to differentiate individuals in different niches. Research efforts have been paid to the setting of the niche radius parameter. Deb and Goldberg [21] introduced a formula to compute the niche radius. The formula uses the radius of the smallest hypersphere containing the feasible space, which is given as:

$$R = \frac{1}{2} \sqrt{\sum_{i=1}^{P} (x_i^u - x_i^l)^2}$$

where $D$ represents the number of dimensions of the problem at hand, $x_i^u$ and $x_i^l$ are upper and lower bounds of the $i$th dimension. The niche radius is estimated as:

$$r = \frac{R}{\sqrt{N_g}}$$

where $N_g$ is the number of global optima. The formula is based
Can I Write Chinese?

- CJK package, written by Werner Lemberg.
- Available at http://cjk.ffii.org/
- Fonts: bsmi,bkai,gbsn,gkai, ...; also many other free fonts

E.g.
\usepackage{CJKutf8}
\begin{CJK}{UTF8}{bsmi}
Your Chinese goes here
\end{CJK}

- “工欲善其事，必先利其器。”
- There’s also CTeX etc.
- 百度一下“毕业论文模版”
Special Purpose Packages

- All packages are ;-)  
- For posters: A0poster (supports A1–A3 sizes)  
- Slides: beamer  
  - Check out the style matrix  
  - Brilliant tutorial at  
- You can re-use your paper LaTeX source code to the maximal extent  
  - Reports  
  - Papers  
  - Thesis  
  - Presentations  
  - bib files
Converters

- latex2html, htlatex: convert LaTeX source into HTML
- excel2tex: for easier typesetting of tables
- rtf2latex2e: transform your RTF/Word documents into LaTeX2e
  - Works for simple Word documents (not coping well with double columns, equations, tables, pictures ...)
  - Do NOT use for converting your .doc paper to LaTeX
- rtfbeamer: convert PPT(x) to LaTeX
- Pandoc (multi-way, universal document converter)
Other work by Don Knuth
- Things a Computer Scientist Rarely Talks About
- 3:16
- MIT lectures, “God and Computer Science”

Besides LaTeX, the best thing I found in my PhD years is the Bible. Try these –
- Gospel of John
- Epistle to the Philippians

Do check out the personal pages of Rosalind Picard (MIT)
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Questions?