

Effective Programming Practices for Economists

4. A \LaTeX primer

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The case for plain L^AT_EX

- Version control works best with simple text files – so use those for writing papers as well
 - L^AT_EX is the de-facto standard
 - Will see later that it is also very useful for getting closer to that “red button”
- What about the middle ground between plain L^AT_EX and MS Word – Scientific Workplace, LyX?
 - Also format source code – difficult to track changes
 - Not designed for making the source readable by humans – merging conflicts is a pain in the ***

The case for plain \LaTeX

- More control over what is going on
- Makes you worry about structure, not design
- Learning curve is steep
 - But shortly, your mind will ignore the markup commands when reading \LaTeX source code

What is $\text{L}\text{A}\text{T}\text{E}\text{X}$?

- TEX
 - Special-purpose programming language for use in typesetting publication-quality mathematics
 - Developed by Donald Knuth (the Kenneth Arrow of CS)
- $\text{L}\text{A}\text{T}\text{E}\text{X}$
 - Extension of TEX that makes it easier to use (by adding commands)

Tools for writing $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ and producing pdf's

- A text editor
 - See introductory slides
- A $\text{T}_{\text{E}}\text{X}$ distribution
 - Mik $\text{T}_{\text{E}}\text{X}$ or $\text{T}_{\text{E}}\text{X}$ Live are the standards

Design follows structure

- You are responsible for the structure
- \LaTeX will do the design based on that structure
- Concept also called markup

The \LaTeX markup language

Introduction

- Standard text is interpreted as usual
- Multiple whitespace is interpreted as one space
- Exception: An empty line starts a new paragraph
- Commands: Start with backslash, options in square brackets, arguments in curly braces:

```
\command[options]{argument}
```

- E.g. for main structure:

```
\section{Section name}  
\subsection{Subsection name}
```

The L^AT_EX markup language

Source code for simple text

```
\section{Of the division of labour}
```

The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is anywhere directed, or applied, seem to have been the effects of the division of labour.

The effects of the division of labour, in the general business of s

The \LaTeX markup language

Resulting text

1 Of the division of labour

The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is anywhere directed, or applied, seem to have been the effects of the division of labour.

The effects of the division of labour, in the general business of society, will be more easily understood by considering in what manner it operates in some particular manufactures.

The \LaTeX markup language

Environments

- Environments add, remove, or change behaviour of commands:

```
\begin{enumerate}  
  \item First point.  
  \item Second point.  
\end{enumerate}
```

- Some important environments:

document Where you write your text, required in every document

enumerate A numbered list

itemize A bulleted list

equation Numbered formula

align Formulas spanning several lines (Madsen, 2006)

The \LaTeX markup language

Source code for simple environments

```
\begin{document}
```

The first lectures of the course will be:

```
\begin{enumerate}
```

```
  \item Introduction.
```

```
  \begin{itemize}
```

```
    \item Prologue with motivating example.
```

```
    \item Reproducibility.
```

```
    \item Tools used in the course.
```

```
  \end{itemize}
```

```
  \item Version Control.
```

```
\end{enumerate}
```

```
\end{document}
```

The \LaTeX markup language

Resulting text

The first lectures of the course will be:

1. Introduction.

- Prologue with motivating example.
- Reproducibility.
- Tools used in the course.

2. Version Control.

The \LaTeX markup language

Math environments

- Math has special environment delimiters
 - `\(... \)` for inline math
 - `\[... \]` for single-line math
- Subscripts via underscores, superscripts via circumflex in math environments ...
 - Strange errors in usual text – use `_` and `\^`
 - “Escape characters”
- Curly braces delimit groups (e.g. what goes in a subscript or denominator)
- Greek letters via commands in math mode: `\alpha`, `\Delta`

The \LaTeX markup language

Source code for math examples

```
\begin{document}
```

Two important measures for individuals' risk aversion are based on the curvature of a utility function

$(u(x))$ over a monetary quantity (x) .

These are absolute risk aversion:

```
\[
  r_A(x) = -\frac{u''(x)}{u'(x)}
\]
```

and relative risk aversion:

```
\[
  r_R(x) = -x \cdot \frac{u''(x)}{u'(x)}
\]
```

```
\end{document}
```

The \LaTeX markup language

Resulting text

Two important measures for individuals' risk aversion are based on the curvature of a utility function $u(x)$ over a monetary quantity x .

These are absolute risk aversion:

$$r_A(x) = -\frac{u''(x)}{u'(x)}$$

and relative risk aversion:

$$r_R(x) = -x \cdot \frac{u''(x)}{u'(x)}$$

The preamble

- Commands before the `\begin{document}` call
- Need to tell \LaTeX several settings for the entire document upfront
 - Type of document, paper size, margins, how to deal with special characters, margins, symbols (e.g. €) ...
 - Encodings:
`\usepackage[utf8]{inputenc}`
vs.
`\usepackage[latin1]{inputenc}`
 - Save file with appropriate encoding
- Don't worry, use templates!

Compiling documents to pdf's

- Use pdflatex
 - Forget about old documentation floating around (dvi's)
 - Specialised editors have extensions or built-in interfaces
- Might need several runs, other programs to run in between
 - Not yet
 - Use automated tools later
 - Hopefully never need to worry about this
- Error messages not too helpful
 - Focus on line numbers
 - General feature of \LaTeX compilation tools

Tables

- Best done using the `booktabs` package
- Read Fear (2005) for usage
- Read Fear (2005) for style rules






Bibliographies

- Bibliographies one of the big strengths of \LaTeX
- Pull everything out of centralised file (database)
 - Has a peculiar format
 - Use manager, e.g. Jabref on all platforms, BibDesk on Mac
- `biblatex` (Lehman et al., 2013) is a modern package re-implementing original bibliographic functionality
 - Remove the `backend=biber` option if you can't get it to work

Annotated references

- Intro based on <http://www.haptonstahl.org/latex>
- Decent book: Kopka and Daly (2004) (disclaimer)
- Math intro: Grätzer (1996)
- Very useful resources:
 - <http://en.wikibooks.org/wiki/LaTeX/Formatting>
 - <http://en.wikibooks.org/wiki/LaTeX/Mathematics>

References I

-  Fear, Simon (2005). “Publication Quality Tables in \LaTeX ”. Available at <http://www.ctan.org/tex-archive/macros/latex/contrib/booktabs/>.
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-  Kopka, Helmut and Patrick W. Daly (2004). *Guide to \LaTeX* . 4th ed. Addison Wesley / Pearson Education.
-  Lehman, Philipp, Philip Kime, Audrey Boruvka, and Joseph Wright (2013). “The `biblatex` Package: Programmable Bibliographies and Citations”. Available via <http://sourceforge.net/projects/biblatex/>.
-  Madsen, Lars (2006). “Avoid `Eqnarray!`” In: *Prac $T_{E}X$ Journal* 4.

Acknowledgements

- This course is designed after and borrows a lot from the Software Carpentry course designed by Greg Wilson for scientists and engineers.
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