CSCM10 Research Methodology
A Taster of LaTeX

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http://www.cs.swan.ac.uk/∼csetzer/lectures/
computerScienceProjectResearchMethods/current/index.html

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WYSIWYG Systems

- WYSIWYG = "**W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et".
- What you type in can be seen directly on the screen.
- **Microsoft Office Word** is the main example of a WYSIWYG system.

Advantages/Disadvantages of WYSIWYG Systems

- WYSIWYG systems are relatively easy to use.
- In WYSIWYG systems typesetting to be done by the user.
  - Problem: most users are not professional type setters.
- In most systems (e.g. Word) you can see only the output, but not the formatting information.
  - Difficult to detect that one headline is in 11 pt and another in 12 pt, or one headline in one font, and another in a slightly different font.
  - Therefore output is usually inconsistent.
- Usually output not of printable quality.
- Programming is difficult, definition of macros restricted and difficult.

WYSIWYM

- WYSIWYM = "**W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **M**ean".
- Instead of doing the typesetting directly the user says:
  - This is a headline.
  - This is a section title.
  - This text is normal text.
  - This is a mathematical formula
- Main examples: TeXand LaTeX.

Advantages/Disadvantages of WYSIWYM Systems

- Steeper learning curve.
- Separation of output from input, therefore what you write needs to be compiled into text.
- Can create text in print quality.
  - Many publishers print articles typeset in LaTeX directly, or after adding their own generic macros.
- User sees all formatting information and can therefore produce very uniform text.
- Programmable using macros.
  - Development of macro packages for many purposes.
    - In LaTeX macro packages e.g. for chess, for typesetting proofs, chemical formulas exist.
    - These slides are typeset in LaTeX.

LaTeX

- TeX developed by Donald Knuth in order to typeset a new version of his books "The art of Computer Programming".
- LaTeX (for **La**mport-**TeX**) developed by Laslie Lamport in order to make a more user friendly version of TeX.
  - LaTeX is essentially a macro package on top of TeX.

Use of LaTeX for Reports and Dissertation

- Reports and dissertations can be written using any text processing system.
- Use of LaTeX will in many cases give you an advantage because of the much higher quality of the output.
- Many lecturers (but not all) use LaTeX, especially for scientific publishing.
  - They might help you with LaTeX.

Example

- The following shows an example of LaTeX code (split into 3 codes) plus the output.
- For ease of presentation after each code piece the final output (which is only produced after running latex on the whole code) is shown.
- The source for this file is available from the webpage for the lectures by Anton Setzer for this module or here: http://www.cs.swan.ac.uk/∼csetzer/lectures/computerScienceProjectResearchMethods/current/latex/exampleWik

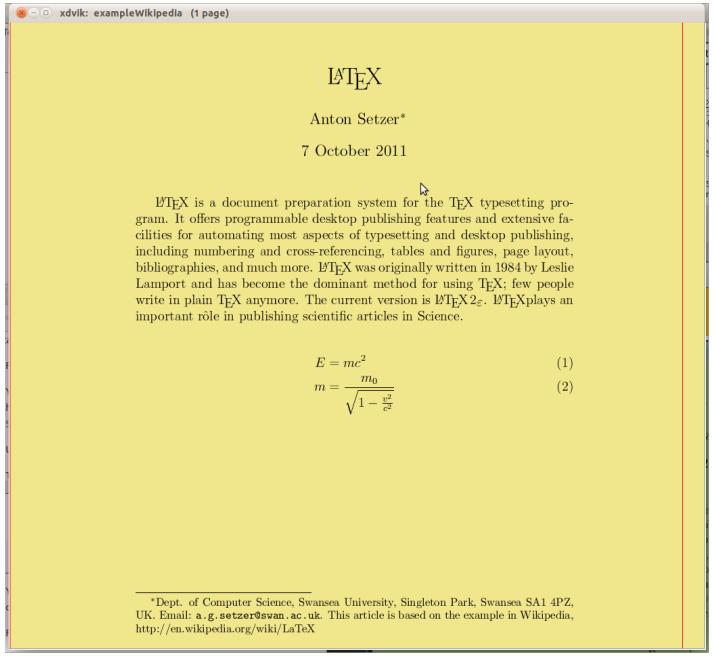
Example

```
\documentclass[12pt]{article}
\usepackage{amsmath}
\title{\LaTeX}
\author{Anton Setzer
  \thanks{Dept.  of Computer Science,
    Swansea University, Singleton Park,
    Swansea SA1 4PZ, UK.
    Email:  {\tt a.g.setzer@swan.ac.uk}.
    This article is based on the example in Wikipedia,
    http://en.wikipedia.org/wiki/LaTeX}}
\date{7 October 2011}

\newcommand{\role}{{r\^{o}le}}

\begin{document}
\maketitle
```


LaTeXOutput

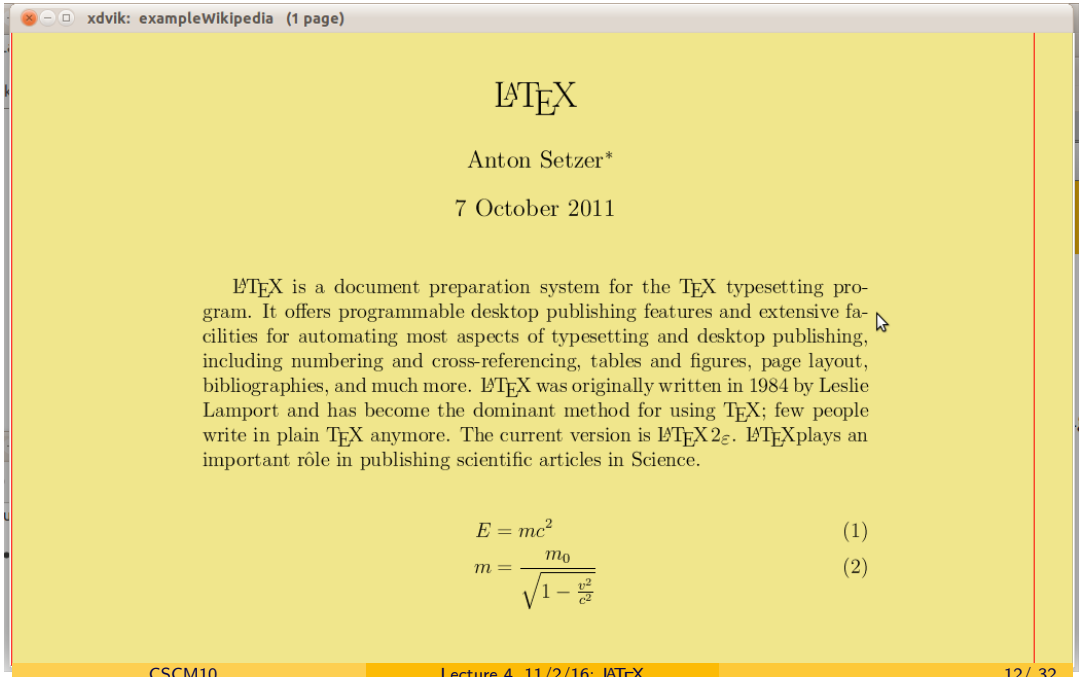


Example (Continued)

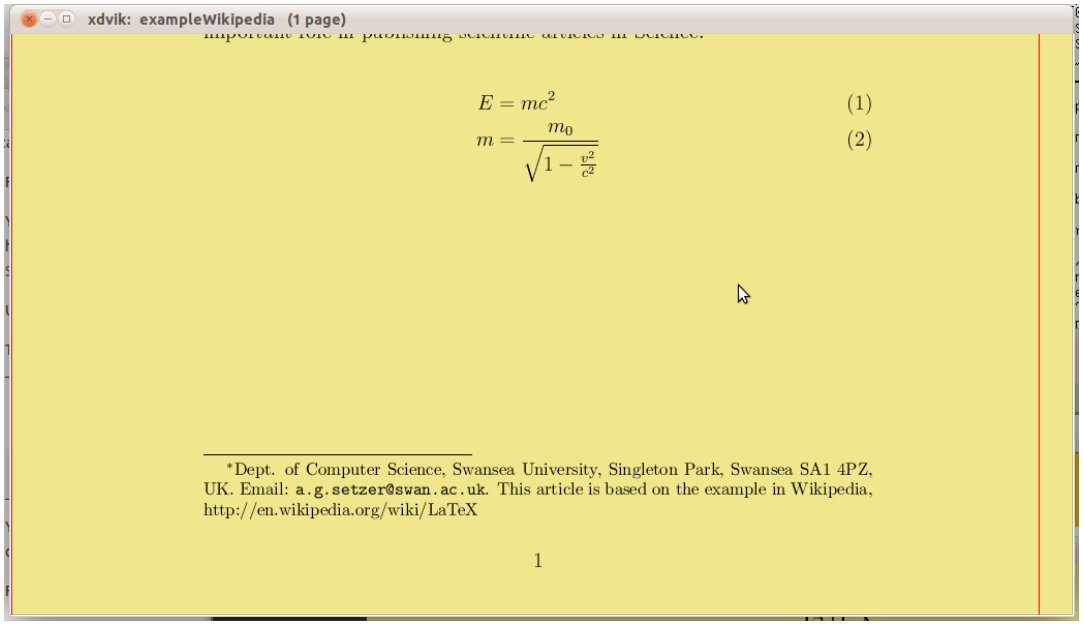
```
\LaTeX{} is a document preparation system for the \TeX{}
typesetting program.  It offers programmable desktop
publishing features and extensive facilities for
automating most aspects of typesetting and desktop
publishing, including numbering and cross-referencing,
tables and figures, page layout, bibliographies, and
much more.
\LaTeX{} was originally written in 1984 by Leslie
Lamport and has become the dominant method for using
\TeX; few people write in plain \TeX{} anymore.
The current version is \LaTeXe.
\LaTeX{} plays an important \role{} in publishing
scientific articles in Science.

% This is a comment; it will not be shown
% in the final output.
```


LaTeXOutput



LaTeXOutput

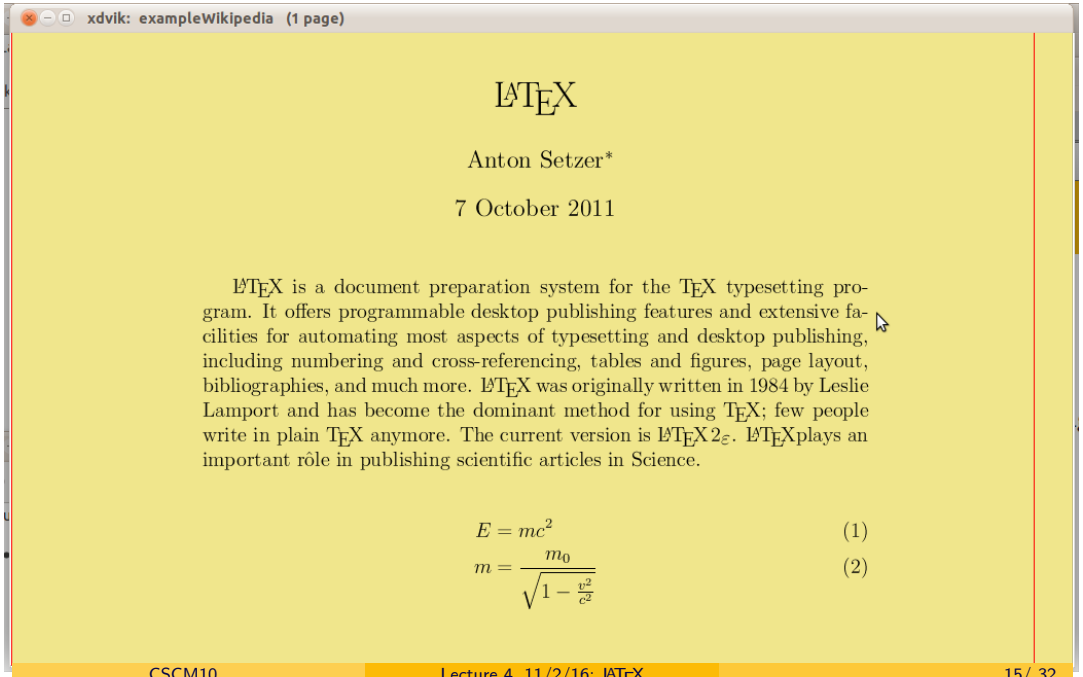


Example (Continued)

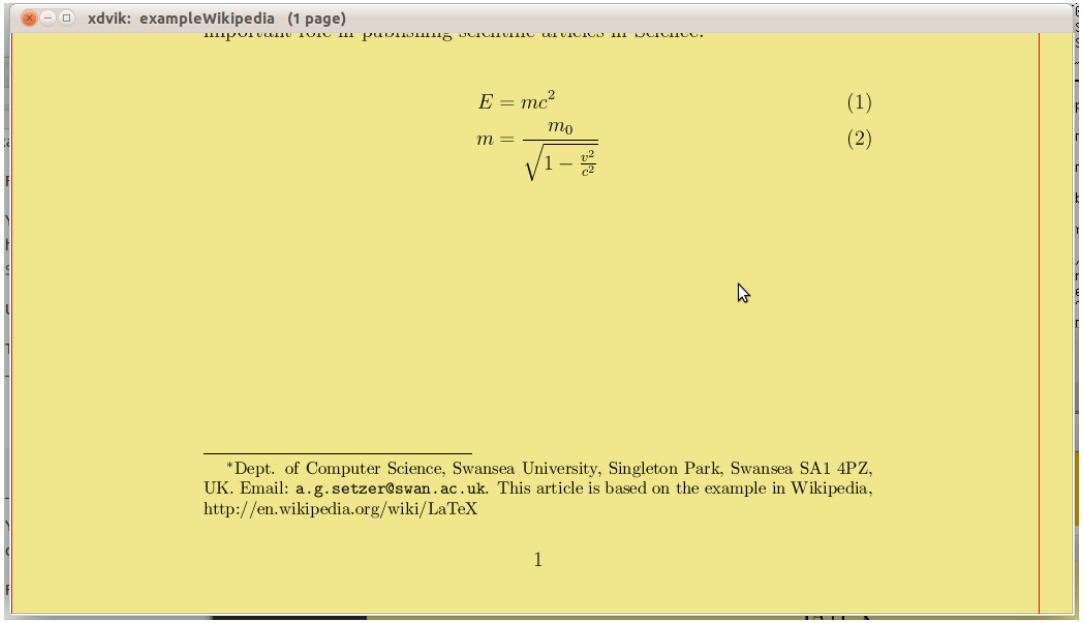
```
% The following shows a little of the typesetting power
% of LaTeX:

\begin{align}
E &= mc^2    \\
m &= \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}
\end{align}
\end{document}
```


LaTeXOutput



LaTeXOutput



Running LaTeX

```
csetzer@csltas2:~> latex exampleWikipedia.tex
latex exampleWikipedia.tex
This is pdfTeX, Version 3.1415926-1.40.10
(TeX Live 2009/Debian)
entering extended mode
(./exampleWikipedia.tex
LaTeX2e <2009/09/24>
Babel <v3.8l> and hyphenation patterns for english,
usenglishmax, dumylang, nohyphenation, farsi,
arabic, croatian, bulgarian, ukrainian, russian, czech,
slovak, danish, dutch, finnish
...  lots of more output ...
Output written on exampleWikipedia.dvi (1 page, 2364 bytes).
Transcript written on exampleWikipedia.log.
csetzer@csltas2:~> xdvi exampleWikipedia.dvi &
```


More Details

- `\documentclass[12pt]{article}`
  - Standard Header of a Latex file.
  - 12pt = font size
  - article = style
    (Article is suitable for reports.
    There are lots of other styles.
    Style "book" is the simplest style for dissertations.
    – There are many more fancy ones.)
- `\usepackage{amsmath}`
  - Loads package amstmath.
  - Rich package for mathematics, here used for command \frac.
  - Lots of packages are available.
- `\title{\LaTeX}`
  - Defines the title.
  - \LaTeX{} is a macro typesetting LaTeX.
- `\author{Anton Setzer`
  - Starts defining the author (note { not closed yet)

More Details

- `\thanks{Dept. of Computer Science,`
  `Swansea University, Singleton Park,`
  `Swansea SA1 4PZ, UK.`
  `Email: {\tt a.g.setzer@swan.ac.uk}.`
  `This article is based on the example in`
  `Wikipedia,`
  `http://en.wikipedia.org/wiki/LaTeX}}`
  - Footnote added to author.
  - {\tt ··· } type sets this part in type writer font.
  - Second "}" finishes definition of author.

  `\date{7 October 2011}`
  - Defines the date.

More Details

- `\newcommand{\role}{{r\^{o}le}}`
  - Defines a macro.
  - From now on \role will expand to {r\^{o}le}.
  - Curly brackets will be used to group text but will not be printed.
  - \^{o} typesets ô
  - There are macros for defining lots and lots of special symbols.
  - http://www.tug.org/tex-archive/info/symbols/comprehensive/
  - Macros can have parameters as well.

More Details

- `\begin{document}`
  - Start of the content of the document.
- `\maketitle`
  - Puts title, author, date at this position.
  - Without this command no title, author, date will occur in the document.

More Details

- `\LaTeX{} is a document preparation system for the \TeX{} typesetting program. It offers ···`
  - This is standard text to be typeset.
  - Aligning the text done by the system.
  - Line breaks in the text create only space between words.
  - Double line breaks creates a paragraph (Equivalently one can use the macro \par).
  - Several blanks, tabs, line breaks are the same as a single space (except for double line breaks).
  - \TeX{} typesets TEX.

More Details

- `\LaTeX{} plays an important \role{} in publishing`
  - Here the user defined macro \role{} typeset as rôle is used.
  - {} here makes sure that there is a blank after LATEXand after rôle.
    Spaces after a macro are ignored.
- `% This is a comment; it will not be shown`
  - Everything in a a line after % is a comment

Example (Continued)

- `\begin{align}`
  `...`
  `\end{align}`
  - Example of an environment.
  - There are many environments in LATEX.

Example (Continued)

- \begin{align}
  $\cdots$ & $\cdots$ \\
  $\cdots$ & $\cdots$ \\
  \end{align}
  - Environment align typesets several formulae, which are numbered as (1), (2) consecutively.
  - Content of an align environment is mathematical text.
    - LaTeX and TeX have a text mode and a formula mode.
    - In formula mode different macros (usually for creating mathematical text) are used.
    - In mathematical text all blanks are ignored.
    - Mathematical text is where the full power of LaTeX/TeXis shown.
    - Seems to be the easiest system for typesetting formulae.
  - \\ separates lines in mathematical text (can be used for ordinary text as well).
  - Symbols & mark positions to be aligned.

Example (Continued)

- c^2
  - Typesets c^2 in mathematical text.
- m_0.
  - Typesets m_0 in mathematical text.
- \frac{$\cdots$}{$\cdots$}
  - Type sets a fraction $\frac{\cdots}{\cdots}$.
  - Note that we can nest fractions.
- \sqrt{$\cdots$}
  - Typesets $\sqrt{\cdots}$.
- \end{align}
  - End of align environment.
- \end{document}
  - End of the document.
  - Text after this will be ignored.

LaTeX under Windows

- Use any text editor. Recommended: Emacs or XEmacs.
- MikTeX is a LaTeX compiler for Windows.
- For viewing dvi files use the included YAP dvi-viewer.
- For postscript use GhostScript + GSView.
- See for instance
  http://www.pinteric.com/miktex.html
  on how to use LaTeX under Windows.
- Other onlinetools avilable e.g. ShareLatex.

BibTex

- BibTex allows to create your bibliography automatically from a BibTex file, in which bibliography entries are listed in a database like syntax.
- Publishers and many authors provide BibTex entries for many publication.
- Google scholar can be adjusted through settings to provide BibTeX entries - however there usually need a lot of adjustments.

Example BibTeX entry

```
@book{kopka2003guide,
      title={Guide to {L}a{T}a{X}},
      author={Kopka, H. and Daly, P.W.},
      edition={4},
      year={2003},
      publisher={Addison-Wesley}
}
```


Example BibTeX entry

- We wrote {L}a{T}a{X}, because BibTeX puts by default everything in lowercase in titles, except for the first character. By using {L} one forces L to be taken as a capital letter.
- Many more fields available, many are optional.
- Fields vary depending on the type.
  - Here type is book as indicated by @book.
  - Examples of types are article, misc, unpublished, inproceedings, proceedings, PhDthesis, and many more.
- This item can now be cited using \cite{kopka2003guide}.
- BibTeX entries are stored in a file with extension .bib
- The bibliography is incorparted into your LaTeX document by using the commands:
  \bibliographystyle{abbrvnat}
  \bibliography{bibtexfilename}
  - There are many different bibliographystyles available.
  - bibtexfilename is the name of your BiBTeX file.

Some Books

- Helmut Kopka, Partrick W. Daly: Guide to LaTeX (Tools and Techniques for Computer Type Settings. Addision-Wesley 4th edition, 2003.
- Leslie Lamport: LaTeX: A document prperation system. User's guide and Reference manual. Addison Wesley, 1994.
- Frank Mittelbach, Michel Goossens: The Latex companion. Addison Wesley, 2nd Edition, 2004.
- Michel Goossens, Frank Mittelbach: The Latex Graphics companion. Addison Wesley, 2nd Edition, 2007.

More Documentation

- Lots of documentation on LaTeX (tutorials, userguides etc) available online.
- Links available on the module home page at http://www.cs.swan.ac.uk/∼csetzer/lectures/computerScienceProjectResearchMethods/current/index.html