

An Introduction to Type-setting projects in \LaTeX 2_ε with the UoYCSProject class

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What is \LaTeX ?

$\text{\LaTeX}2_{\epsilon}$ is a *document description language* built on top of...
 \TeX , a type-setting engine designed by Donald Knuth.

Cf. HTML and SGML/XML applications plus a rendering engine.

A minimal document

Source

```
\documentclass{minimal}  
\begin{document}  
Hello_World.  
\end{document}
```

Output

Hello World.

Why use $\text{\LaTeX} 2_{\epsilon}$?

- The sophisticated type-setting algorithm of \TeX , and the enhanced algorithm of *pdf ϵ tex*. [▶ the \$\text{\TeX}\$ showcase.](#)
- The huge number of pre-defined packages for doing common things. [▶ the \$\text{\TeX}\$ catalogue](#)
- The ability to define your own special purpose structures.
- Stable basis.
- Good for large, academic documents.

References

There are many good references for $\text{T}_{\text{E}}\text{X}$ and friends.

See “*A guide to type-setting project reports in $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ with the *UoYCSproject class*”*. [▶ Guide](#)

Marc van Dongen produced a video to advertise his book, while gently introducing $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$: [▶ Video](#).

UoYCSProject

a class for project reports

There are many pre-defined document classes:

Base minimal, article, report, book, letter, slides.

KOMA-Script scrartcl, scrreprt, scrbook, scrlltr2.

Memorandum memorandum.

Others ..., beamer, ..., UoYCSproject , ...

Text, commands and environments

A $\text{\LaTeX} 2_{\epsilon}$ source is a mix of:

text Some text.,

commands \LaTeXe , $\text{\ensurmath{\frac{2}{3}}}$, and

environments $\text{\begin{verse}}$

```
Much have I travell'd in the realms of gold,\\
And many goodly states and kingdoms seen;\\
Round many western islands have I been\\
Which bards in fealty to Apollo hold.\\
Oft of one wide expanse had I been told\\
That deep-browed Homer ruled as his demesne;\\
Yet did I never breathe its pure serene\\
Till I heard Chapman speak out loud and bold:\\
Then felt I like some watcher of the skies\\
When a new planet swims into his ken;\\
Or like stout Cortez when with eagle eyes\\
He star'd at the Pacific — and all his men\\
Look'd at each other with a wild surmise —\\
Silent, upon a peak in Darien.
```

$\text{\end{verse}}$

Examples typeset

*Much have I travell'd in the realms of gold,
And many goodly states and kingdoms seen;
Round many western islands have I been
Which bards in fealty to Apollo hold.
Oft of one wide expanse had I been told
That deep-browed Homer ruled as his demesne;
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Look'd at each other with a wild surmise —
Silent, upon a peak in Darien.*

L^AT_EX 2_ε

2
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3

The anatomy of a LaTeX source

```
\documentclass[class options]{class name}  
preamble (definitions and declarations)  
\begin{document} % this is a comment.  
body  
\end{document}
```

The anatomy of a UoYCSproject preamble

```

\documentclass{UoYCSproject}
%_Order_of_declarations_does_not_matter.
\author{Anne_Student-Name}
\title{A_Solution_to_the_Problem_of_{$\mathit{P}=\mathit{NP}$}}
\date{30_February_2000}
\supervisor{Prof._Z._Soporific}
\MEng
\wordcount{2,345}\excludes{Appendix~\ref{sec:code}}
\dedication{To_My_Cat,_Jeoferry}
\abstract{The_well_known_problem_of_{$P=NP$}_is_explained,
_ _together_with_its_significance_and_a_brief_history_of
_ _attempts_to_solve_it._ _Aningenious_solution_is_presented.}
\begin{document}
...
\end{document}

```

A full list of declarations is given in [▶ Guide](#), Figure 7.1, P 46.

Extra definitions and package loading

- You can load extra packages and make your own definitions.
- These go in a file with the same name as your main file, but extension ‘`ldf`’. This is different to the way all other classes work.
(I have implemented `UoYCSproject` in this way to ensure that packages are loaded in the correct order.)
- Useful packages include: `listings` , `graphics`, `graphicx`, `pgf/tikz` , `amsmath`.

The anatomy of the body

Front matter Title pages, abstract, contents, &c.

Main matter The text, divided into (parts,) chapters (, sections, subsections, subsubsections, paragraphs and subparagraphs).

Back matter Bibliography, appendices &c.

Front matter

```
\maketitle % Compulsory: title pages, table of contents  
\listoffigures % Optional: the list of figures  
\listoftables % Optional: the list of tables  
... % Optional, package dependent lists,  
... % e.g. \lstlistoflistings
```

Main matter

```
\part{title}           % Optional
\chapter{title}        % Compulsory
\section{title}        % Optional
\subsection{title}     % Optional
\subsubsection{title}  % Optional
\paragraph{title}      % Optional
\subparagraph{title}   % Optional
Text.  Text.
```

Back matter

```
\bibliography{file 1,file 2} % Construct bibliography
\appendix % remaining chapters are appendices
\chapter{title} % One per appendix
\section{title} % Optional
\subsection{title} % Optional
\subsubsection{title} % Optional
\paragraph{title} % Optional
\subparagraph{title} % Optional
Text. Text.
```

Text elements

Characters Can control series, family, shape, colour and size of each text character. See [▶ Guide](#), §6.3.3.

Sentences `Sentence_one.` `Sentence_two.`

Paragraphs `Paragraph_one.` `% blank line separates paragraphs`

`Paragraph_two.`

Special features

Context dependent emphasis `\emph{...}\emph{...}`

Cross references Sectional units, floats, equations, &c.

Quotations Short and long

Citations

Lists Bulleted, numbered and labelled

Tables

Pictures

Floats Tables, Figures and others.

Citations and the bibliography

- Through the `natbib` package, set up for IEEE style.
- `\citep{Joyce:FW}` —cite parenthesised— generates [34], assuming `Joyce:FW` is the label of the 34th reference.
Do not use this form as a noun.
- `\citet{Joyce:FW}` —cite as text— generates Joyce [34], assuming also that the author's surname is 'Joyce'.
You may use this form as a noun.
- Rule: your document should read naturally when all the citation markers (eg the '[34]', but not the 'Joyce') are removed.

Citations are kept in a database in a flat file and processed by a program called BibT_EX before inclusion in output file. [▶ Example database](#)

Mathematics

Very powerful facilities. May be enhanced by `amsmath` packages (best advice is to *always* load `amsmath`).

Inline Here is a formula: $\sum_{i=1}^n i = \frac{n(n+1)}{2}$; isn't it beautiful?

Displayed Here is a formula:

$$\sum_{i=1}^n i = \frac{n(n+1)}{2} \quad (1)$$

Isn't it beautiful?

Definitions

- A major reason for using \LaTeX . Create special-purpose commands and environments for the structures in *your* document.

- To define a command called `\UoY` that prints ‘The University of York’:

```
\newcommand*\UoY{The University of York}
```

- To define a command that has two parameters:

```
\newcommand*{C}[2]{_{\#1}C^{\#2}}
```

```
\begin{math}C_{x+2}{3y}\end{math} type-sets as  $x_{+2}C^{3y}$ .
```

Case study: Cryptographic protocols

Syntax and form of messages

A *message* has three components: *sender*, *receiver* and *content*. So we write our document in terms of a command `\msg` that has 3 parameters:

`\newcommand*{\msg}[3]{BODY}`

Two possible definitions for `BODY`:

- 1 `#1\rightarrow#2:#3`
- 2 `#2\Leftarrow\left[#3\right]\Leftarrow#1`

The call `\msg{S}{R}{C^{A^B}}` produces

- 1 $S \rightarrow R : C^{A^B}$ or
- 2 $R \Leftarrow [C^{A^B}] \Leftarrow S$ respectively.

Case study: Cryptographic protocols

Syntax of message sequences

A protocol is a sequence of messages. So we write our document in terms of an environment that collects a sequence of messages.

We will write, for example:

```
\begin{protocol}  
    \msg{A}{B}{X,Y,Z}  
    \sep \msg{B}{C}{W,X}  
    \sep \msg{C}{B}{W,X'}  
\end{protocol}
```

Case study: Cryptographic protocols

Desired form of message sequences

Now we design the printed form.

- 1 The output should have numbered messages to which labels can be attached. Each message should be printed on a line of its own.
- 2 The definitions of `\msg` and `\sep` should be local to the environment.

Case study: Cryptographic protocols

Form of message sequences

```

\newcounter{msgnumber}
\newenvironment*{protocol}
{ % set up
  \setcounter{msgnumber}{0}%
  \newcommand*{\msg}[3]{%
    \refstepcounter{msgnumber}%
    \themsgnumber&##1&##2&##3}
  \newcommand*{\sep}{\;}
  \begin{math}\displaystyle%
    \begin{array}{l}
      {r@{.}\quad}|@{\rightarrow}|@{\;:\;}|}
    \end{array}
  \end{math}
{ % finalise
  \end{array}\end{math}}

```


Case study: Cryptographic protocols

The end product

Source

```
\begin{protocol}  
    \msg{A}{B}{X,Y,Z}  
    \sep \msg{B}{C}{W,X}  
    \sep \msg{C}{B}{W,X'}  
\end{protocol}
```

Output

1. $A \rightarrow B : X, Y, Z$
2. $B \rightarrow C : W, X$
3. $C \rightarrow B : W, X'$