

TEX and L^ATEX

- TEX created by Donald E. Knuth in late 70's.
- “A Typesetting-Oriented Programming Language.”
- L^ATEX, a macro package on top of TEX by Leslie Lamport in mid-80's.
- A markup language, *not* WYSIWYG.
- Somewhat useful converters, e.g. latex2html.
- <http://www.ftp.funet.fi/pub/TeX/CTAN/index.html>

First Example

```
\documentclass[a4paper]{article}
\usepackage[finnish]{babel}
\usepackage[latin1]{inputenc}
\usepackage[T1]{fontenc}

\begin{document}

\section{Ensimmäinen runo}
Mieleni minun tekevi, aivoni ajattelevi
lähteä laulamahan, saa'ani sanelemahan,
...
\end{document}
```

```
> latex kalevala.tex
...
> xdvi kalevala.dvi
...
> dvips -f kalevala.dvi > kalevala.ps
...
> gv kalevala.ps
...
> lpr kalevala.ps
```

Second Example

```
...
\title{Kalevala}
\author{Elias Lönnrot}
\date{\today}

\begin{document}

\maketitle

\section{Ensimmäinen runo}
Mieleni minun tekevi, aivoni ajattelevi
lähteä laulamahan, saa'ani sanelemahan,
...
```

Third Example

...

```
\begin{document}
```

```
\maketitle
```

```
\begin{abstract}
```

Eepinen tarina Suomen esikristillisestä historiasta.

Neliosainen kokoperheen jatkosarja. Sankareina

vaka vanha Väinämöisestä, Kullervo Kalervon poika,

Pohjan Akka, ja moni muu.

```
\end{abstract}
```

```
\tableofcontents
```

```
\clearpage
```

```
\section{Ensimmäinen runo}
\subsection{Lauluunkutsu}
Mieleni minun tekevi, aivoni ajattelevi
lähteäni laulamahan, saa'ani sanelemahan,
...
\subsection{Väinämöinen}
\subsubsection{Aino}
\input{aino.tex}

\section{Toinen runo}
...
\section{Kolmas runo}
...
\end{document}
```

Characters

- Backslash `\` begins a command.
- A space after a command disappears:

<code>\TeX can</code>	<code>TeXcan</code>
<code>\TeX\ can</code>	<code>TeX can</code>
- Characters `% $ & # _ { and }` can be produced by preceding them with a backslash.
- `\~{}` is `~`, `\^{}{}` is `^`, `$_backslash$` is `\`.
- `%` comments away the rest of the line.
- The input `E1 se\~{n}or est\'{a} bien, gar\c{c}on` gives
El señor está bien, garçon.
- One `-` is a hyphen, two is longer `–`, three `—`
- `~` is a non-breakable space, e.g. `10~kg`, `Mr.~Spock`

- Fonts:

`\rm` is Times-Roman

`\it` *is Italic*

`\sl` *is Slanted*

`\tt` is Teletype (Courier)

`\bf` is **Boldface**

`\sc` IS SMALL CAPS

Prefer `\em` for *emphasis*.

- Sizes: `\tiny`, `\scriptsize`, `\footnotesize`, `\small`, `\normalsize`, `\large`, `\Large`, `\LARGE`, `\huge`, `\Huge`.

Use these only locally:

one `{\large\sc two}` three

one TWO three.

Tables

- The input

```
\begin{tabular}{|l|c|} \hline
  {\em Student} & {\em Grade} \\ \hline
  12376 & 5 \\
  1690 & 3 \\ \hline
\end{tabular}
```

produces

<i>Student</i>	<i>Grade</i>
12376	5
1690	3

Mathematics

- The input x^2+1 produces $x^2 + 1$.
- The input $x_1 + x_2 + \cdots + x_{\infty} < 1$ produces $x_1 + x_2 + \cdots + x_{\infty} < 1$.
- The input $\sum_{i=1}^{\infty} x_i < 1$ produces $\sum_{i=1}^{\infty} x_i < 1$.
- The input $\sum_{i=1}^{\infty} x_i < \binom{n}{n/2}$ produces

$$\sum_{i=1}^{\infty} x_i < \binom{n}{n/2}.$$

- The input $\sqrt{2} \notin \mathbb{N}$ produces $\sqrt{2} \notin \mathbb{N}$ when the `amssymb`-packet is in use.

- The input `$$\forall x : P(x) \Rightarrow \exists y : Q(x,y) \wedge \int_x^y f(t) dt \leq \pi$$` produces

$$\forall x : P(x) \Rightarrow \exists y : Q(x, y) \wedge \int_x^y f(t) dt \leq \pi.$$

- The input

```
$f_i = \begin{cases} 1 & i < 2, \\ f_{i-1} + f_{i-2} & \text{otherwise.} \end{cases}$
```

produces $f_i = \begin{cases} 1 & i < 2, \\ f_{i-1} + f_{i-2} & \text{otherwise.} \end{cases}$

when the `amsmath`-packet is in use.

Referencing

- `\tableofcontents`
- `\listoffigures`
- `\listoftables`
- Cross-referencing. In the referring place, e.g.

in `Section~\ref{section:kullervo}` we discussed

and in the referred place

```
\section{Yhdeksäs runo}
```

```
\label{section:kullervo}
```

Similarly for other objects, e.g.

according to Equation~\ref{eq:total-execution-time}

and in the referred equation

```
\begin{equation}
  \label{eq:total-execution-time}
  l_c + C_r(s,0) l_r + C_w(s,0) l_w.
\end{equation}
```

- Figures are typically imported as follows:

```
\begin{figure}
  \begin{center}
    \leavevmode
    \psfig{figure=kullervo.eps,height=9cm}
    \caption{Kullervon uho Albert Edelfeltin mukaan.}
    \label{fig:kullervo}
  \end{center}
\end{figure}
```

- Tables are typically implemented as follows:

```
\begin{table}[ht]
  \begin{center}
    \leavevmode
    \begin{tabular}{lcc}
      ...
    \end{tabular}
    \caption{Summary of notation.}
    \label{tab:notation}
  \end{center}
\end{table}
```

- Indexes (not relevant for the course)

```
\index{Processor cache|main}
```

```
\index{Cache!processor|see{Processor cache}}
```

```
\index{External cache|main}
```

```
\index{Cache!external|see{External cache}}
```

```
\index{Cache line|main}
```

Current {\em processor caches} contain several hundred, even thousands of blocks usually called {\em cache lines}~\cite{Smi82}, each containing for example 16 or 32 bytes. {\em External caches} may contain tens of thousands of cache lines.

In most current computers a processor cache hit typically costs from 10 to 30~ns, an external cache hit typically costs 50 to 200~ns, while filling a cache line from main memory typically costs 200 to 500~ns~\cite{Oks95}.

- The program `makeindex` creates the actual index file, which can be included into the `LATEX`-document with the command `\printindex`
- You may need to compile a `LATEX`-document several times before all cross references refer to the correct page.

- References

Appel~\cite{appe87} has stated that ...

Inclusion of a BIB_TE_Xfile:

```
\bibliographystyle{abbrv}
```

```
\bibliography{foobar}
```

In foobar.bib:

```
@article{appe87,  
title = "Garbage Collection can be Faster than Stack Allocation",  
author = "Andrew W. Appel",  
address = "...",  
journal = IPL,  
publisher = NH,  
year = 1987,  
volume = 25,  
number = 4,  
pages = "275--279",  
...  
}
```

- Huge BIB_{TEX}-files are readily available

<http://citeseer.nj.nec.com/>

<http://www-ccs.cs.umass.edu/db/bib-search.html>

Recap

- Document classes: `article`, `report`, `book`, `letter`, `slides`
- Features in `article` ja `report`: `11pt`, `12pt`, `twoside`, `twocolumn`
- Hierarchies: `part`, `chapter` (not in use in articles), `section`, `subsection`, `subsubsection`, `paragraph`, `subparagraph`.
The asterisk drops the number, e.g.
`\section*{Ensimmäinen runo}`
`\appendix` begins appendices.
- Most important environments: `document`, `verbatim`, `quote`, `verse`, `center`, `itemize`, `enumerate`, `description`, `math`, `displaymath`, `equation`, `tabular`, `footnote`, etc., look at CTAN!
- `%` `$` `&` `#` `_` `{` `}` `~` `^` `\`
- Start with a template!