세미나

LaTeX의 소개

1993년 1월 9일

서 두 원

정보 통신 연구실

source : KAIST

목 차

1 소 개

1.1 TEX

- Donald E. Knuth
- typesetting system
- 원시적이면서 강력함
- 기본적으로 수학 typesetting 용

1.2 LATEX

- Leslie Lamport
- TEX의 macro
- 문서작성시 편리
  - 각종 목차 자동 생성
  - label을 사용한 cross-reference 방법 제공
  - floating table , figure
  - ...

1.3 WYSWIG ?

- logical design
- batch processing
- previewing, printing

1.4 LATEX 맛보기 : 간단한 예제

1.4.1 결과를 얻으려면

1. 텍스트 입력 : 텍스트 에디터를 이용하여 LATEX문법에 맞는 문서 작성
2. LATEX돌리기 : 입력 텍스트를 typesetting 하는 과정
3. 출력기로 출력하기 : X 화면(preview)이나 프린터로 출력

1.4.2 입력 텍스트

```
\documentstyle{article}
\begin{document}
  KAIST      is Korea Advanced
  Institute    of Science and          Technology. CAlab is
     Computer Architecture     Labratory.

  This    is a test.
\end{document}
```

1.4.3 출력 결과

KAIST is Korea Advanced Institute of Science and Technology. CAlab is Computer Architecture Labratory.

This is a test.

1.4.4 LaTeX돌리기

`latex` *file*`.tex`

1.4.5 출력 결과 얻기

- 화면으로 Preview :

  `xdvi` *file*`.dvi`

- 프린터로 출력[1] :

  `dvips` *file*`.dvi`
  `lpr` *file*`.ps`

[1] 이것은 cair의 setting을 예로 든 것임

2 문서 만들기

2.1 문서 모양 정하기

2.1.1 문서 스타일

- 형식 :

  `\documentstyle[`*options*`]{`*style*`}`

- 스타일 종류 :

  `article`, `report`, `book`, `letter`

- option 종류 :

  `11pt`, `12pt`, `twocolumn`

2.1.2 페이지 스타일

- 형식 :

  `\pagestyle{`*style*`}`

- 스타일 종류 :

  `plain` , `headings`, `empty`

- `thispagestyle`
- `pagenumbering`

2.2 문자 입력하기

2.2.1 주의해야하는 문자들

- `#` `$` `%` `&` `_` { } : _ 를 반드시 써야함 (예: `\#`)
- `|` `<` `>` : math mode에서 사용
- ‘ ’ “ ” : ‘ ’ ‘ ‘ ’ ’ 사용
- ˜ ˆ \ : simulated keyboard input 방법 사용

2.2.2 Dash

- hyphen : `-` (예 : X-ray)
- midium dash : `--` (예 : 1–2)
- punctuation dash : `---` (예 : a — or b — is an alphabet)

2.2.3 Accent , ...

입력	출력	입력	출력
`\'o`	ò	`\'o`	ó
`\^o`	ô	`\~o`	õ
`\=o`	ō	`\.o`	ȯ
`\u o`	ŏ	`\v o`	ǒ
`\c o`	o̧	`\d o`	ọ
`\b o`	o̲	`\t oo`	o͡o
`\oe`	œ	`\OE`	Œ
`\ae`	æ	`\AE`	Æ
`\aa`	å	`\AA`	Å

2.2.4 Symbol

†	`\dag`	§	`\S`	©	`\copyright`
‡	`\ddag`	¶	`\P`	£	`\pounds`

2.3 글자 모양및 크기 변화

2.3.1 글자 모양

- `\rm` : roman (normal) type
- `\bf` :**bold type**
- `\it` : *italic type*
- `\sf` : sans serif
- `\sl` : *slanted type*
- `\sc` : Small Caps
- `\tt` : `typewriter type`
- `\em` : *emphasized type*

2.3.2 글자 크기

- `\tiny` : Computer Architecture
- `\scriptsize` : Computer Architecture

- `\footnotesize` : Computer Architecture
- `\small` : Computer Architecture
- `\normalsize` : Computer Architecture
- `\large` : Computer Architecture
- `\Large` : Computer Architecture
- `\LARGE` : Computer Architecture
- `\huge` : Computer Architecture
- `\Huge` : Computer Architecture

2.4 장, 절 나누기

`\section{...}`

- `article` : `\part`, `\section`, `\subsection`, `\subsubsection`
- `report`, `book` : `\part` , `\chapter` ,`\section`, `\subsection` , `\subsubsection`

2.5 간격 주기 (spacing)

2.5.1 수평 간격

단어, 문장 사이 간격 주기

- `\␣` : extra space

"1 2 3 4."	`‘‘ 1 \ 2 \ 3 \ \ 4.’’`

- `\hspace{...}` : horizontal space

in this	`in \hspace{1cm} this`

- `\/` : 기울어진 문자뒤에 사용

*did*n't	`{\it did}n't`
*did*n't	`{\it did\/}n't`

- `~` : 한 문자크기의 간격

Chapter 15	`Chapter~15`

2.5.2 수직 간격

줄과 문단 사이 간격 주기

- `\\` : 강제로 줄 넘기기
- `\vspace{...}` : vertical space

I love Computer Architecture Lab

in KAIST.

```
I love Computer Architecture Lab

\vspace{1cm}

in KAIST.
```

- fill : `\hfill` , `\vfill`

A and B

```
A and \hfill B
```

2.6 Environment

2.6.1 인용 : quote, quotation, verse

- `quote` environment

This is an example.

> ... it's a good idea to join CA lab.

It is indented at both margins.

```
This is an example.
\begin{quote}
\ldots\ it's a good idea to join CA lab.
\end{quote}
It is indented at both margins.
```

- `quotation` environment : 여러 문단이 있을 경우
- `verse` environment : 시 등을 사용할 때

2.6.2 타자친 텍스트처럼 : verbatim , verb

- `verbatim`

```
What the %$%##~^\_ is ‘‘ going’’
{on} hear ????? today\\\???
```

```
\begin{verbatim}
What the %$%##~^\_ is ‘‘ going’’
{on} hear ????? today\\\???
\end{verbatim}
```

- `\verb`

the `\dots` produce ...

```
the \verb|\dots| produce \dots
```

2.6.3 list : itemize, enumerate, description

- `itemize` , `enumerate`

Here are main research topics :

- Parallel Processing Architectures
  - Parallel Algorithms
  - Interconnection Network
- Real-Time and Fault-Tolerant Architectures
  1. Real-Time Computing Architectures
  2. Fault-Tolerant Computer Systems

```
Here are main research topics :
\begin{itemize}
\item Parallel Processing Architectures
\begin{itemize}
\item Parallel Algorithms
\item Interconnection Network
\end{itemize}
\item Real-Time  .... Architectures
\begin{enumerate}
\item Real-Time Computing Architectures
\item Fault-Tolerant Computer Systems
\end{enumerate}
\end{itemize}
```

- `description`

There are many labs in CS Dept. as following :

calab Computer Architecture Lab.

selab Software Engineering Lab.

cslab Computer System Lab.

```
There are many labs in CS Dept. as following :
\begin{description}
\item [calab] Computer Architecture Lab.
\item [selab] Software Engineering Lab.
\item [cslab] Computer System Lab.
\end{description}
```

2.6.4 탭 주기 : tabbing

one	two	three
ein	zwei	drei

```
\begin{tabbing}
1234 \= 1234567 \= 12345678 \kill
one \> two \> three \\
ein \> zwei \> drei
\end{tabbing}
```

2.6.5 표 그리기 : tabular

Cho	Jung	Wan
Maeng	Seung	Ryoul
Lee	Heung	Kyu
Yoon	Hyun	Soo

```
\begin{tabular}{||c|rl||} \hline
Cho & Jung & Wan \\  \hline \hline
Maeng & Seung & Ryoul \\
Lee & Heung & Kyu \\
Yoon & Hyun & Soo \\  \hline
\end{tabular}
```

2.6.6 flushright, flushleft, center

Right-flushed
text.

Centered
text.

Left-flushed
text.

```
\begin{flushright}
Right-flushed\\ text.
\end{flushright}
\begin{center}
Centered\\ text.
\end{center}
\begin{flushleft}
Left-flushed\\ text.
\end{flushleft}
```

2.6.7 그림과 표 : figure, table

```
This is a figure.

\begin{figure}
\vspace{2cm}
\caption{example figure}
\end{figure}

This is a table.

\begin{table}
\vspace{2cm}
\caption{example table}
\end{table}
```

This is a figure.
This is a table.

그림 1: example figure

표 1: example table

2.7 comment

This is a real text. KAIST is nice place.

```
This is a real text. % But
KAIST is nice        % this is
place.               %  comments
```

2.8 footnote

footnote[a] is ...

[a]this is a footnote.

```
footnote\footnote{this is a footnote.} is ...
```

3 수 식 (Mathematical Formulas)

3.1 수식 mode

- `$ ... $` , `\( ... \)` : inline mode

Formula $x - 2y = 7$ is easy to type. `Formula $ x - 2y = 7 $ is easy to type.`

- `\[ ... \]` : display math

Formula

$$x - 2y = 7$$

is easy to type.

`Formula \[ x - 2y = 7 \] is easy to type.`

- 주의

different and $different$ `{\em different\/} and $different$`

3.2 기본적인 것

- 윗 첨자 `^` , 아래 첨자 `_`

x^{2y}	`x^{2y}`	$x^{y^{2}}$	`x^{y^{2}}`	x^{y}_{1}	`x^{y}_{1}`
x_{2y}	`x_{2y}`	$x^{y_{1}}$	`x^{y_{1}}`	x_{1}^{y}	`x_{1}^{y}`

- 분수 `\frac`

$$x = \frac{a+1}{1+\frac{a}{b}}$$

`x = \frac{a+1}{1+\frac{a}{b}}`

- 생략

$\ldots$ `\ldots` $\cdots$ `\cdots` $\ddots$ `\ddots` $\vdots$ `\vdots`

- root `\sqrt` , summation `\sum` , integral `\int`

Type $\sqrt{x+y}$, $\sqrt[n]{2}$, $\sum_{x=1}^{n} = \int_{0}^{1} f$.
Also do this :

$$\sum_{x=1}^{n} = \int_{0}^{1} f$$

```
Type $\sqrt{x+y}$ , $\sqrt[n]{2}$ ,
$\sum_{x=1}^{n} = \int_{0}^{1} f$.
Also do this :
\[\sum_{x=1}^{n} = \int_{0}^{1} f\]
```

- 그리스 문자 , 각종 기호

$\alpha \div \beta \sim \Phi$ `\alpha \div \beta \sim \Phi`

- log-like :

$\lim_{x \to 0} \frac{\sin x}{x} = 1$ `\lim_{x \to 0} \frac{\sin x}{x} = 1`

- `\overline` , `\underline`

$\overline{m+n}$ and $\underline{a+b}$ `$\overline{m+n}$ and $\underline{a+b}$`

- `\overbrace` , `\underbrace`

$\overbrace{a+b+\cdots+z}^{26}$ `$\overbrace{a+b+\cdots+z}^{26}$`

- accent '

$y' \not= y''$ `y'\not= y''`

- `\mbox` : math mode에서 텍스트 입력

표 2: Log-like functions

`\arccos`	`\cos`	`\csc`	`\exp`	`\ker`	`\limsup`	`\min`	`\sinh`
`\arcsin`	`\cosh`	`\deg`	`\gcd`	`\lg`	`\ln`	`\Pr`	`\sup`
`\arctan`	`\cot`	`\det`	`\hom`	`\lim`	`\log`	`\sec`	`\tan`
`\arg`	`\coth`	`\dim`	`\inf`	`\liminf`	`\max`	`\sin`	`\tanh`

표 3: mathematical Accents

`\hat a`	$\hat{a}$	`\check a`	$\check{a}$
`\tilde a`	$\tilde{a}$	`\acute a`	$\acute{a}$
`\grave a`	$\grave{a}$	`\dot a`	$\dot{a}$
`\ddot a`	$\ddot{a}$	`\breve a`	$\breve{a}$
`\bar a`	$\bar{a}$	`\vec a`	$\vec{a}$

표 4: Greek Letters

α	\alpha	ι	\iota	ϱ	\varrho
β	\beta	κ	\kappa	σ	\sigma
γ	\gamma	λ	\lambda	ς	\varsigma
δ	\delta	μ	\mu	τ	\tau
ϵ	\epsilon	ν	\nu	υ	\upsilon
ε	\varepsilon	ξ	\xi	ϕ	\phi
ζ	\zeta	o	o	φ	\varphi
η	\eta	π	\pi	χ	\chi
θ	\theta	ϖ	\varpi	ψ	\psi
ϑ	\vartheta	ρ	\rho	ω	\omega
Γ	\Gamma	Ξ	\Xi	Φ	\Phi
Δ	\Delta	Π	\Pi	Ψ	\Psi
Θ	\Theta	Σ	\Sigma	Ω	\Omega
Λ	\Lambda	Υ	\Upsilon		

표 5: Variable-sized Symbols

$\sum$	\sum	$\bigcap$	\bigcap	$\bigodot$	\bigodot
$\prod$	\prod	$\bigcup$	\bigcup	$\bigotimes$	\bigotimes
$\coprod$	\coprod	$\bigsqcup$	\bigsqcup	$\bigoplus$	\bigoplus
$\int$	\int	$\bigvee$	\bigvee	$\biguplus$	\biguplus
$\oint$	\oint	$\bigwedge$	\bigwedge		

표 6: Binary Operation Symbols

$+$	+	$-$	-		
$\pm$	\pm	$\cap$	\cap	$\vee$	\vee
$\mp$	\mp	$\cup$	\cup	$\wedge$	\wedge
$\setminus$	\setminus	$\uplus$	\uplus	$\oplus$	\oplus
$\cdot$	\cdot	$\sqcap$	\sqcap	$\ominus$	\ominus
$\times$	\times	$\sqcup$	\sqcup	$\otimes$	\otimes
$\ast$	\ast	$\triangleleft$	\triangleleft	$\oslash$	\oslash
$\star$	\star	$\triangleright$	\triangleright	$\odot$	\odot
$\diamond$	\diamond	$\wr$	\wr	$\dagger$	\dagger
$\circ$	\circ	$\bigcirc$	\bigcirc	$\ddagger$	\ddagger
$\bullet$	\bullet	$\bigtriangleup$	\bigtriangleup	$\amalg$	\amalg
$\div$	\div	$\bigtriangledown$	\bigtriangledown		

표 7: Relation Symbols

$<$	<	$>$	>	$=$	=
$\leq$	\leq	$\geq$	\geq	$\equiv$	\equiv
$\prec$	\prec	$\succ$	\succ	$\sim$	\sim
$\preceq$	\preceq	$\succeq$	\succeq	$\simeq$	\simeq
$\ll$	\ll	$\gg$	\gg	$\asymp$	\asymp
$\subset$	\subset	$\supset$	\supset	$\approx$	\approx
$\subseteq$	\subseteq	$\supseteq$	\supseteq	$\cong$	\cong
$\sqsubseteq$	\sqsubseteq	$\sqsupseteq$	\sqsupseteq	$\bowtie$	\bowtie
$\in$	\in	$\ni$	\ni	$\Join$	\Join
$\vdash$	\vdash	$\dashv$	\dashv	$\models$	\models
$\smile$	\smile	$\mid$	\mid	$\doteq$	\doteq
$\frown$	\frown	$\parallel$	\parallel	$\perp$	\perp
				$\propto$	\propto

표 8: Arrow Symbols

$\leftarrow$	\leftarrow	$\longleftarrow$	\longleftarrow	$\uparrow$	\uparrow
$\Leftarrow$	\Leftarrow	$\Longleftarrow$	\Longleftarrow	$\Uparrow$	\Uparrow
$\rightarrow$	\rightarrow	$\longrightarrow$	\longrightarrow	$\downarrow$	\downarrow
$\Rightarrow$	\Rightarrow	$\Longrightarrow$	\Longrightarrow	$\Downarrow$	\Downarrow
$\leftrightarrow$	\leftrightarrow	$\longleftrightarrow$	\longleft...	$\updownarrow$	\updownarrow
$\Leftrightarrow$	\Leftrightarrow	$\Longleftrightarrow$	\Longleft...	$\Updownarrow$	\Updownarrow
$\mapsto$	\mapsto	$\longmapsto$	\longmapsto	$\nearrow$	\nearrow
$\hookleftarrow$	\hookleftarrow	$\hookrightarrow$	\hookrightarrow	$\searrow$	\searrow
$\leftharpoonup$	\leftharpoonup	$\rightharpoonup$	\rightharpoonup	$\swarrow$	\swarrow
$\leftharpoondown$	\leftharpoondown	$\rightharpoondown$	\rightharpoondown	$\nwarrow$	\nwarrow
$\rightleftharpoons$	\rightleftharpoons			$\leadsto$	\leadsto

표 9: Delimiters

$($	(	$[$	[	$\{$	\{
$[$	\lbrack	$\lfloor$	\lfloor	$\lceil$	\lceil
$\{$	\lbrace	$\langle$	\langle		
$)$	)	$]$	]	$\}$	\}
$]$	\rbrack	$\rfloor$	\rfloor	$\rceil$	\rceil
$\}$	\rbrace	$\rangle$	\rangle		

표 10: Miscellaneous Symbols

$\aleph$	`\aleph`	$\prime$	`\prime`	$\forall$	`\forall`
$\hbar$	`\hbar`	$\emptyset$	`\emptyset`	$\exists$	`\exists`
$\imath$	`\imath`	∇	`\nabla`	$\neg$	`\neg`
$\jmath$	`\jmath`	$\surd$	`\surd`	$\flat$	`\flat`
ℓ	`\ell`	$\top$	`\top`	$\natural$	`\natural`
$\wp$	`\wp`	$\bot$	`\bot`	$\sharp$	`\sharp`
$\Re$	`\Re`	$\|$	`|`	$\clubsuit$	`\clubsuit`
$\Im$	`\Im`	$\angle$	`\angle`	$\diamondsuit$	`\diamondsuit`
∂	`\partial`	$\triangle$	`\triangle`	$\heartsuit$	`\heartsuit`
∞	`\infty`	$\backslash$	`\backslash`	$\spadesuit$	`\spadesuit`
$\mho$	`\mho`	$\Box$	`\Box`	$\Diamond$	`\Diamond`

3.3 수식 묶음 처리

- array

$$\begin{array}{clr}
a+b+c & uv & 27 \\
a+b & u+v & 124 \\
a & u+v+w & 345
\end{array}$$

```
\begin{array}{clr}
a+b+c & uv & 27 \\
a+b & u+v & 124 \\
a & u+v+w & 345
\end{array}
```

- delimiter `\left` , `\right`

$$\left(\begin{array}{c}
\left| \begin{array}{cc} x_{11} & x_{12} \\ x_{21} & x_{22} \end{array} \right| \\
y \\ z
\end{array} \right)$$

```
\left( \begin{array}{c}
\left| \begin{array}{cc}
... \end{array} \right| \\
y \\ z
\end{array} \right)
```

$$x = \left\{ \begin{array}{ll}
y & \mbox{if $y>0$} \\
z+y & \mbox{otherwise}
\end{array} \right.$$

```
x = \left\{ \begin{array}{ll}
y & \mbox{if $y>0$} \\
z+y & \mbox{otherwise}
\end{array} \right.
```

- multiline formular : `eqnarray` , `eqnarray*`

$$\begin{array}{rcll} x & = & y & (1) \\ y & > & a+\cdots+j & \\ & & +k & (2) \end{array}$$

```
\begin{eqnarray}
 x & = & y \\
 y & > & a + \cdots + j \nonumber \\
   &   & \mbox{} + k
\end{eqnarray}
```

$$\begin{array}{l} w+x= \\ \qquad a+...+j+ \\ \qquad k+l \end{array}$$

```
\begin{eqnarray*}
\lefteqn{w+x =} \\
   &  & a+ ... +j + \\
   &  &  k + l
\end{eqnarray*}
```

3.4 간격주기

$\|\,\|$ `\,`	thin space	$\|\:\|$ `\:`	medium space
$\|\;\|$ `\;`	thick space	$\|\!\|$ `\!`	negative space

$\int\!\!\!\int_{D} dx\,dy$ instead of $\int\int_{D} dxdy$

```
\int\!\!\!\int_{D} dx\,dy
\qquad \mbox{instead of} \quad
 \int\int_{D} dxdy
```

3.5 Theorem , . . .

There are many architectures studied in CAlab; this is the first one:

Architecture 1 *The basic idea of a parallel architecture is to trade hardware for speed as effectively as possible.*

```
\newtheorem{arch}{Architecture}
There are many architectures
studied in CAlab ....
\begin{arch}
The basic idea of a parallel
architecture is to trade ...
```

4 기 타 : 알아두어야 하는것들

4.1 새로운 command, environment 정의

- `\newcommand`
  `\newcommand{\oi}{$\Omega_{i}$}`
- `\newenvironment`
  `\newenvironment{cozy}{`*begin text* `}{`*end text* `}`

Here is an example of a user-defined environment:

  - *This environment produces emphasized items.*
  - *It is defined in terms of* LaTeX *'s* `itemize` *environment and* `\em` *command.*

```
\newenvironment{emp}{\begin{itemize}
\em}{\end{itemize}}
... example of a user-defined ...
\begin{emp}
\item This environment produces ....
\end{emp}
```

4.2 Cross-reference

`\label` , `\ref` , `\pageref`

Equation **??** in Section 2.3 below is Euler's famous result.

⋮

2.3 Early Results

Euler's equation

$$e^{i\pi} + 1 = 0 \qquad (3)$$

combines the five most important numbers in mathematics in a single equation. See page **??** for more details.

```
Equation~\ref{eq:euler} in
Section ~\ref{sec-early} below
...
\subsection{Early Results}
\label{sec-early}
Euler's equation
\begin{eqnarray}
e^{i\pi} + 1 = 0 \label{eq:euler}
\end{eqnarray}
combines the five most ...
See page ~\pageref{here}
for more details\label{here}.
```

4.3 참고 문헌과 참조

`thebibliography` , `\bibitem` , `\cite`

See [Knud 66] for the hairy details.

⋮

References

⋮

[Knud 66] D. E. Knudson, *1966 World Gnus Almanac,* Permafrost Press, Novsibirsk.

```
See \cite{kn:gnus} for ....
...
\begin{thebibliography}{Abcd 99}
...
\bibitem[Knud 66]{kn:gnus}  D. E. Knudson,
{\em 1966 World Gnus Almanac,}  ...
\end{thebibliography}
```

4.4 목차 생성

- `\tableofcontents`
- `\listoffigures`
- `\listoftables`

4.5 입력 화일 쪼개기 : input, include

- `\input{...}`
- `\include{...}`
- `\includeonly{...}`

4.6 error 대처

입력 오류 :

```
\begin{itemie}
\item A test program for ...
\item More ...
\end{itemize}
```

결과 :

```
LaTeX error.  See LaTeX manual for explanation.
              Type  H <return>  for immediate help.
! Environment itemie undefined.
\@latexerr ...for immediate help.}\errmessage {#1}

l.4 \begin{itemie}

?
```

5 한글 다루기

5.1 한글 문서를 만들기 위한 방법

- 한글 document style사용

  `\documentstyle{harticle}`

- `hfont`를 option으로 사용

  `\documentstyle[..,hfont,..]{article}`

5.2 한글을 위한 Document Style

- `harticle`
- `hreport`
- `hbook`
- `hmsthesis`

5.3 한글 LaTeX 돌리기

- 문서 작성 : 완성형 한글 문서 준비

  `vi` *file*`.ks`

- 변환 : 완성형 한글 문서를 LaTeX에서 처리할 수 있도록 변환

  `htex` *file*`.ks` *file*`.tex`

- LaTeX으로 처리

  `latex` *file*`.tex`

- `hlatex` : shell script

5.4 글자 모양

- `\rm` : 명조(보통)체
- `\bf` :**굵은 명조체**
- `\gt` : **고딕체**
- `\gr` : 그래픽체
- `\dr` : **디나루체**

5.5 한글 사용시 주의 사항

1. 한글을 `verbatim`, `\verb`에서 사용할 수 없음
2. math mode에서 한글을 수식으로 사용할 수 없음
   (`\mbox` 사용하여 부분적으로 한글 사용가능)
3. label로 한글을 사용할 수 없음

6 추천 서적

1. L. Lamport : LaTeX, *A Document Preparation System, User's Guide and Reference Manual*, Addison-Wesley Publishing Company (1985)
2. D. Buerger, LaTeX *for Scientists and Engineers*, McGraw-Hill (1990)