LaTeX소개 2부 : 수학, BibTeX, 사용자 정의

공개 통계학 개론 (OpenIntro Stat.) 저작 학습용

David Diez [1]   이광춘(번역) [2]

[1]OpenIntro openintro.org

[2]xwMOOC xwmooc.net

목차

Guide to LaTeX

Guide to LaTeX 책에는 LaTeX에 대한 멋진 안내가 나와 있고, 이번 학습에서 이 책에서 나온 예제 일부를 충실히 따라간다:

7 수학

11,12 BibTeX

10 사용자 정의 명령어와 환경

LaTeX에 관한 학습교재를 찾는다면, *Guide to LaTeX* 책은 훌륭한 대안이 될 수 있다.

LATEX수학

LATEX에서 제공하는 수학 환경 몇가지 측면을 다룰 예정이다.

- 텍스트에 수식 기초

- 다양한 방정식 환경

- 수학 기호

- 수학 표현식

- 텍스트 강조와 변형

- 괄호 기호의 자동 크기 조정

- 수학 방정식에 텍스트

- 배열과 행렬

수식을 텍스트에 삽입

LaTeX에서 α, ζ, μ ... 같은 그리스 문자를 추가하기 쉽다. 동일한
방식으로 방정식도 쉽게 추가될 수 있다: $y = x^3$, $\sum z^j$,
$x_1 + \cdots + x_n$.

> LaTeX makes it easy to add Greek letters like α, ζ,
> μ, etc. into text. In the same way, equations can be added
> easily as well: $y=x^3$, $\sum z^j$, $x_1+\cdots+x_n$.

$ 기호는 LaTeX으로 하여금 언제 수식 모형으로 들어가거나
빠져나올지를 일러준다. 예를 들어, 상기 α 를 생성하려면,
α 타이핑한다.

β을 어떻게 생성할 수 있을까요?

Equation array

Some equations are long and should be on their on lines. In such a case, use the `eqnarray` or `eqnarray`* environment:

```
\begin{eqnarray*}
\sum_{k=0}^{\infty}0.5^k = \frac{1}{1-0.5} = 2
\end{eqnarray*}
```

The result in LaTeX for `eqnarray`*:

$$\sum_{k=0}^{\infty} 0.5^k = \frac{1}{1 - 0.5} = 2$$

Equation referencing

Just like tables and figures, equations can be referenced. Use `eqnarray` (no asterisk) to add an equation number:

$$\sum_{k=0}^{\infty} 0.5^k = \frac{1}{1-0.5} = 2 \tag{1}$$

`\label{powerSeries}` can be put inside the equation array and then be referenced via `\ref{powerSeries}`.

```
\begin{eqnarray}
\sum_{k=0}^\infty 0.5^k = \frac{1}{1-0.5} = 2
\label{powerSeries}
\end{eqnarray}
```

Aligned equations

Another environment, `align` (and `align`[*]) are handy for aligning
multiline equations.

```
\begin{align}
(a+b)^3 &= (a+b) (a^2 + 2ab + b^2) \notag \\
        &= a^3 + 3a^2b + 3ab^2 + b^3
\end{align}
```

Result:
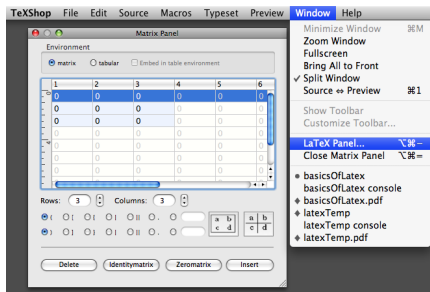
$$(a + b)^3 = (a + b)(a^2 + 2ab + b^2)$$
$$= a^3 + 3a^2b + 3ab^2 + b^3 \qquad (2)$$

The $\backslash\backslash$ command creates a line break. The command $\backslash$notag was
used to suppress the equation number of the first line, which
requires the `amsmath` package. (Q: We have an equation number.

Multiple alignments

The `align` environment permits several alignments:

```
\begin{align*}
(a+b)^0 &=1                        & (a+b)^1 &= a+b \\
(a+b)^2 &=a^2 + 2ab + b^2    & (a+b)^3 &= a^3 + 3a^2b + 3ab^2 + b^3
\end{align*}
```

outputs

$$(a+b)^0 = 1 \qquad\qquad (a+b)^1 = a+b$$

$$(a+b)^2 = a^2 + 2ab + b^2 \qquad (a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

Mathematics and symbols

It is a little difficult to learn all the math syntax and a good help source is the LaTeX and Matrix Panels:

The Matrix Panel is especially useful since matrices can require a lot of writing. The LaTeX panel is handy as a quick reference.

Some symbols

Here is a very small subset of the symbols available in LaTeX.

$\leftarrow$	\$\leftarrow\$	$\Leftarrow$	\$\Leftarrow\$	$\leftrightarrow$	\$\leftrightarrow\$
$\geq$	\$\geq\$	$\neq$	\$\neq\$	$\notin$	\$\not\in\$
∂	\$\partial\$	$\oint$	\$\oint\$	∇	\$\nabla\$
$\bigcap$	\$\bigcap\$	$\bigcup$	\$\bigcup\$	$\cap$	\$\cap\$
$\subset$	\$\subset\$	$\supseteq$	\$\supseteq\$	$\not\supseteq$	\$\not\supseteq\$
$\bigodot$	\$\bigodot\$	$\bigotimes$	\$\bigotimes\$	$\oplus$	\$\oplus\$
$\clubsuit$	\$\clubsuit\$	$\perp$	\$\perp\$	$\vdash$	\$\vdash\$

For a searchable PDF with thousands of symbols, see

www.ctan.org/tex-archive/info/symbols/comprehensive/symbols-

a4.pdf

Also see the LaTeX Panel (under the menu item Window).

Character modifications

Text and symbols in math mode can also be modified.

Regular		Modified		Accents	
`$R$`	R	`$\mathbb{R}$`	$\mathbb{R}$	`$\tilde{R}$`	$\tilde{R}$
`$A$`	A	`$\mathcal{A}$`	$\mathcal{A}$	`$\widetilde{A}$`	$\widetilde{A}$
`$x$`	x	`$\mathbf{x}$`	$\mathbf{x}$	`$\bar{x}$`	$\bar{x}$
`$p$`	p	`$\mathit{p}$`	p	`$\hat{p}$`	$\hat{p}$
`$X$`	X	`$\mathrm{X}$`	X	`$\widehat{X}$`	$\widehat{X}$

Two other accents: $\dot{x}$ and $\ddot{x}$ via `$\dot{x}$` and `$\ddot{x}$`.

Subscripts and exponents

We can create subscripts (e.g. x_1) and superscripts (e.g. 3^2):

> We can create subscripts (e.g. x_{1}) and
> superscripts (e.g. 3^{2}):

When the subscript is a single character, then it is acceptable to omit the curly braces. That is, the following is equally acceptable for the text above:

> We can create subscripts (e.g. x_1) and
> superscripts (e.g. 3^2):

If more than one character is in the sub/superscript, braces are necessary to avoid problems: 2_10 outputs 2_10. Sub and superscripts can be used simultaneously: x_{ij}^2.

Fractions and roots

We can easily create fractions such as $\frac{2+3}{4+5} = \frac{5}{9}$ or roots such as $\sqrt{81} = 9$ and $\sqrt[4]{81} = 3$.

We can easily create fractions such as $\frac{2+3}{4+5} = \frac{5}{9}$
or roots such as $\sqrt{81}=9$ and $\sqrt[4]{81} = 3$.

And we can combine them as well: $\frac{\sqrt{4}+3}{\sqrt{16}+5} = \frac{5}{9}$.

And we can combine them as well:
$\frac{\sqrt{4} + 3}{\sqrt{16} + 5} = \frac{5}{9}$.

Sums and integrals

We can also create sums and integrals:

```
\begin{align*}
\sum_{i=0}^{\infty} p^i &= \frac{1}{1-p}  & \int_{1}^{2}3x^2dx       &= 7 \\
\sum\nolimits_{i=0}^{\infty} 0.5^i &= 2   & \int\limits_{1}^{1}3x^2dx &= 0 \\
\end{align*}
```

which results in

$$\sum_{i=0}^{\infty} p^i = \frac{1}{1-p} \qquad\qquad \int_{1}^{2} 3x^2 dx = 7$$

$$\sum\nolimits_{i=0}^{\infty} 0.5^i = 2 \qquad\qquad \int\limits_{1}^{1} 3x^2 dx = 0$$

The commands $\nolimits$ and $\limits$ can be used to override the default displays of limits in LaTeX.

Practice

Produce the following result using the `eqnarray*` environment:

$$\sum_{i=0}^{n} p^i = \frac{1 - p^{n-1}}{1 - p}$$

Some examples may be utilized in `latexTemp.tex`.

Sizing of Brackets

A small problem with bracket sizes is shown in the left equation, and this problem is fixed on the right.

$$(\frac{2+3}{4+5}) \qquad\qquad \left(\frac{2+3}{4+5}\right)$$

The coding for the expressions above

```
\begin{align*}
  (\frac{2+3}{4+5}) &&& \left(\frac{2+3}{4+5}\right)
\end{align*}
```

Generally we can use $\left($, $\left[$, $\left|$, and $\left\{$ and their corresponding right brackets to create automatically sized brackets. These commands *must* be inside one of the equations environments and the left and right brackets must always be balanced.

Matrices

Matrices also can be made in LaTeX:

$$\left(\begin{array}{ccc} 4 & 1 & 19 \\ 3 & 8 & 8 \end{array} \right)$$

The code:

```
\begin{eqnarray*}
\left(\begin{array}{ccc} 4 & 1 & 19 \\
  3 & 8 & 8 \end{array}\right)
\end{eqnarray*}
```

The syntax for an array is the same as for tabular (a table).

Space and stacking

Space can be added in equations using \quad, and expressions can
be stacked via \stackrel:

> \begin{eqnarray*}
>
>   E(X+Y) \stackrel{indep.}{=} E(X) + E(Y)
>
>   \quad\quad
>
>   Var(X+Y) \stackrel{indep.}{=} Var(X) + Var(Y)
>
> \end{eqnarray*}

produces

$$E(X + Y) \stackrel{indep.}{=} E(X) + E(Y) \qquad Var(X + Y) \stackrel{indep.}{=} Var(X) + Var(Y)$$

Organizer and time saver

The \include command is useful for long documents:

    \include{otherDocName}

For instance, this presentation actually calls three separate documents: one for each big section. Thus I would not take time Typesetting parts of the document I was not working on while keeping organized:

    \include{math/math} % "math" document in the "math" folder

    %\include{bibtex/bibtex}

    %\include{comenv/comenv}

Wrap-up

After this class, you should have a general idea of

- using the math modes in LaTeX,

- creating bibliographies using BibTeX, and

- creating your own commands and environments.

Any questions?