

How Agile Students Can Deliver a Great Master Thesis using L^AT_EX

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1 Introduction

The objective of this guide is to provide concise directions on how to create a basic L^AT_EX document. L^AT_EX offers a wide variety of tools to help students communicate ideas clearly. L^AT_EX has a wide array of commands and capabilities, and this guide gives a brief overview of some of these features. The features introduced in this guide are explained in detail in several publications [2, 3, 4, 5]. The information provided here is all you will need to create almost any direct source document for L^AT_EX.

2 Document Structure

L^AT_EX is a document processing system. What you write is formatted into a pre-defined document style. L^AT_EX has four standard document styles: `article`, `book`, `report`, and `letter` (J. styles: `jarticle`, `jbook`, `jreport`, `jletter`). The style you choose defines how L^AT_EX will perform the actual typesetting. By choosing a different document style, it is possible to convert the layout of your document into a new format.

Documents can be divided into conventional units such as parts and chapters. It is also possible to select more detailed test subdivisions such as sections and subsections. A table of contents can be automatically generated with these sectional tools. Other commands can generate a title page, an appendix, a bibliography, or an index.

3 Typing Text

Text is entered in a similar manner as a word processor (wordpad) or text editor (emacs, vi, WinShell and T_EX editor, Hidemaru editor etc.). By following a few simple conventions, L^AT_EX will transform your text input file into a typeset document.

L^AT_EX's automatic typesetting abilities can implement accurate hyphenation, proportional spacing between words, kerned letter combinations and ligatures. Kerning is a typesetting technique that adjusts the amount of space between two characters.

The distance is based on the width of each character. Some character pairs look better when they are moved closer together, and others look better when they are spaced farther apart. Ligatures are letter combinations joined together as one unit, e.g. `ff`, `fi`, `fl`, and `ffl`.

4 Type Styles and Size

Typeset documents ordinarily don't have underlined text, but are emphasized in italic. Italic can be generated by typing `\emph{emphasized}`. The `\emph` converts the type to an 'emphasized mode'. The curly brackets on both sides of the word employ a grouping technique to restrict the emphasis solely to the text within the braces.

Other options are explained where it is possible to use different typefaces such as **boldface**, SMALL CAPS, *sans serif*, *slanted*, and **typewriter typefaces**. It is also possible to change type size, `scriptsize`, `footnote-size`, and there are different size options such as `small`, `normal size`, `large`, `Large`, `LARGE`, `huge` and `Huge`.

5 Formatting Environment

The formatting environment makes it possible to control the appearance of the text. An environment is a section of the text in which an indicated formatting feature is applied. The typeface changes illustrated above is one example of environment change. When curly brackets are typed *on both sides* of a word with the "*emphasis*" command (e.g. `\emph{emphasis}`), the command is restricted to the text *within* the braces. This is analogous to scoping aspects used in computer programming. Another way to create an environment is with `\begin{ }` and `\end{ }` commands, much in the same way that computer programmers use subroutines to transfer program control to libraries of subprograms. This process allows you to use preset environments for different types of lists, centered text,

quotations, flush right and flush left text, mathematical symbols and equations, tabs, figures and tables.

6 Mathematical Symbols and Equations

L^AT_EX has powerful capabilities for formatting mathematical symbols, expressions and equations. Equations such as $R_m(A) = \prod_{j=1}^m (I - \omega_j A)$ can be placed in a text line, or in ‘display’ mode:

$$R_m(A) = \prod_{j=1}^m (I - \omega_j A) \quad (1)$$

```
1: \begin{equation}
2:   R_m(A)=\prod_{j=1}^m(I-\omega_j A)
3: \end{equation}
```

Displayed equations can have automatically generated equation numbers appear in the right (or left) margin. Another mathematical equation [1, pp. 73] feature is the capability to produce an array such as:

$$B_k = \begin{pmatrix} 1 & -\beta_2 & \cdots & 0 \\ & 1 & -\beta_3 & \vdots \\ & \ddots & \ddots & \ddots \\ \vdots & & \ddots & \ddots & -\beta_k \\ 0 & \cdots & & & 1 \end{pmatrix}.$$

The L^AT_EX source code of the above equation is as follows:

```
1: \[ B_k= \left(\begin{array}{ccccc}
2:   1 & -\beta_2 & & \cdots & 0 \\
3:   & 1 & -\beta_3 & & \vdots \\
4:   & & \ddots & \ddots & \ddots \\
5:   \vdots & & & \ddots & -\beta_k \\
6:   0 & \cdots & & & 1 \\
7: \end{array}\right).\]
```

Below, is an example of a multiline equation:

$$\sum_{n=0}^{\infty} \left(-2 \sinh^2 \left(\frac{D}{2} \right) \right)^n \varphi = \frac{1}{1 + 2 \sinh^2(D/2)} \varphi$$

$$= \frac{1}{\cosh D} \phi$$

The source code is:

```
1: \begin{Equarray*}
2: \sum_{n=0}^{\infty} \left( -2 \sinh^2 \left( \frac{D}{2} \right) \right)^n \varphi
3: \frac{D}{2} \right)^n \varphi
4: &= \frac{1}{1 + 2 \sinh^2(D/2)} \varphi \\
5: &= \frac{1}{\cosh D} \phi
6: \end{Equarray*}
```

In addition to its equation capabilities, L^AT_EX can deliver a large assortment of mathematical symbols, arrow symbols, log-like function names, and equation delimiters [2, 3, 4, 5].

Tab. 1 Binary Multiplication

×	1	10	11	100	101
1	1	10	11	100	101
10	10	100	110	1000	1010
11	11	110	1001	1100	1111
100	100	1000	1100	10000	10100
101	101	1010	1111	10100	11001

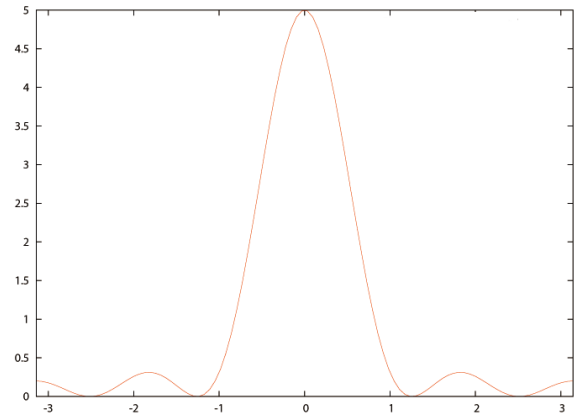


Fig. 1 Graph of the Fejér kernel. This is a graph of $F_5(u)$.

7 Other Document Tools

L^AT_EX can create figures and tables such as Table 1 and Figure 1. It can also create footnotes¹ and make cross-references. The latter can be either forward or reverse references to chapters, sections, tables, figures, equations and even page numbers.

References

- [1] Barrett, R. et al., “Templates for the Solution of Linear Systems: Building Blocks for Iterative Methods,” SIAM, 1994.
- [2] Lamport, L., “L^AT_EX: A Document Preparation System,” Addison-Wesley Professional; 2nd Edition, 1994.
- [3] Mittelbach, F. et al., “L^AT_EX Companion,” Addison-Wesley Professional; 2nd edition, 2004.
- [4] Nodera, T., “Easy Going L^AT_EX,” (Japanese) Kyoritu Pub., 2nd Edition, 1994.
- [5] Prince, T. E. and Carnes, L., “L^AT_EX Quick Start: A First Guide to Document Preparation,” Personal T_EX Inc., 2009.
- [6] Rasmusson, J., “The Agile Samurai,” The Pragmatic Bookshelf, 2010.

¹ Footnote will wrap to the following page if necessary.

\LaTeX Source File

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 %%%%%%%%% Example: extended abstract for master thesis
3 %%%%%%%%% version 1.0
4 %%%%%%%%% file name: sample_eng.tex
5 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
6 %----- start preamble -----
7 \documentclass[a4paper]{jarticle} % 10pt fonts, default fonts
8 %\documentclass[a4paper,11pt]{jarticle} % 11pt fonts
9 %\documentclass[a4paper,12pt]{jarticle} % 12pt fonts
10 %-----
11 \usepackage{masterabs} % 修士論文アブストラクトのスタイルファイル
12 %-----
13 %\usepackage{amsmath,amsthm,mathrsfs} % amslatex モードの指定
14 %\usepackage{amsmath,amssymb,txfonts} % amsfonts の指定
15 \usepackage{graphicx} % 図の挿入の指定 (\includegraphics など)
16 %-----
17 % \columnseprule = 0.4pt % two column の真ん中に縦線を引く
18 %----- 英文の場合: 表, 図, 参考文献を英語に変更 -----
19 \initenglish % 本文が英文の場合は % を取る (表=>Tab., 図=>Fig. など)
20 %-----
21 %
22
23 %----- end preamble -----
24 %
25 %%%%%%%%% TEXT START %%%%%%%%%
26
27 \begin{document}
28 %
29 %----- two column -----
30 \twocolumn[ % two column の場合は, 先頭の % を取る
31 %-----
32 %
33 %-----
34 \no_tlfmark % タイトルの最後に footnote mark を付けない場合は, 先頭の % を取る
35 %-----
36 %% タイトルが 1 行 \title{タイトル}を使う
37 %% タイトルが 2 行にわたるときは \2title{1 行目}{2 行目}を使う
38 %-----
39 %\title{How Agile Students Can Deliver a Great Master Thesis using \LaTeX{}} % 1 行用
40 %
41 \2title{How Agile Students Can Deliver a Great}{Master Thesis using \LaTeX{}} % 2 行用
42 %
43 %-----
44 % 日本語指導教員, 著者名など
45 %-----
46 \begin{preliminary}
47 \profname{Master Sensei} %% (講師, 准教授, 教授) + 指導教員の名前
48 \name{12345678}{Samurai Student} %% 学籍番号, 著者名
49 \end{preliminary}
50 %
51 %----- two column -----
52 ]% two column の場合は, 先頭の % を取る
53 %-----
54 %
55 %----- footnote に英文のタイトルを記述したいとき -----
56 %\etitle{English Title}
57 %-----
58 %
59 \init_fnmark % 脚注マークの初期化 (アラビア数字に変更)
60 %%%%%%%%% 本文 %%%%%%%%%
61

```

62 `\section{Introduction}`
63 The objective of this guide is to provide concise directions on how
64 to create a basic `\LaTeX{}` document. `\LaTeX{}` offers a wide variety of
65 tools to help students communicate ideas clearly. `\LaTeX{}` has a wide
66 array of commands and capabilities, and this guide gives a brief
67 overview of some of these
68 features. The features introduced in this guide are explained in detail
69 in several publications~\cite{lamport94, mittelbach04, nod94, prince09}.
70 The information provided here is all you will need to create
71 almost any direct source document for `\LaTeX{}`.
72
73 `\section{Document Structure}`
74 `\LaTeX{}` is a document processing system. What you write is formatted
75 into a pre-defined document style. `\LaTeX{}` has four standard
76 document styles: `article`, `book`, `report`, and `letter` (J. styles:
77 `jarticle`, `jbook`, `jreport`, `jletter`). The style you choose defines
78 how `\LaTeX{}` will perform the actual typesetting. By choosing a
79 different document style, it is possible to convert the layout
80 of your document into a new format.
81
82 Documents can be divided into conventional units such as parts and
83 chapters. It is also possible to select more detailed test
84 subdivisions such as sections and subsections. A table of contents can be
85 automatically generated with these sectional tools. Other commands can
86 generate a title page, an appendix, a bibliography, or an index.
87
88 `\section{Typing Text}`
89 Text is entered in a similar manner as a word processor (`wordpad`)
90 or text editor (`emacs`, `vi`, `WinShell` and `\TeX{}` editor, `Hidemaru`
91 editor etc.). By following a few simple conventions, `\LaTeX{}` will
92 transform your text input file into a typeset document.
93
94 `\LaTeX{}`'s automatic typesetting abilities can implement accurate
95 hyphenation, proportional spacing between words, kerned letter
96 combinations and ligatures. Kerning is a typesetting technique that
97 adjusts the amount of space between two characters. The distance is
98 based on the width of each character. Some character pairs look
99 better when they are moved closer together, and others look better
100 when they are spaced farther apart. Ligatures are letter
101 combinations joined together as one unit, e.g. `ff`, `fi`, `fl`, and `ffl`.
102
103 `\section{Type Styles and Size}`
104 Typeset documents ordinarily don't have `\underline{underlined}` text,
105 but are emphasized in italic. Italic can be generated by typing
106 `\verb!\emph{emphasized}!`. The `\verb!\emph!` converts the type to an
107 'emphasized mode'. The curly brackets on both sides of the word
108 employ a grouping technique to restrict the emphasis solely to
109 the text within the braces.
110
111 Other options are explained where it is possible to use different
112 typefaces such as `\textbf{boldface}`, `\textsc{small caps}`,
113 `\textsf{sans serif}`, `\textsl{slanted}`, and
114 `\texttt{type\textbackslash-writer typefaces}`. It is also possible to change
115 type size, `{\scriptsize scriptsize}`, `{\footnotesize footnotesize}`,
116 and there are different size options such as `{\small small}`,
117 `{\normal size}`, `{\large large}`, `{\Large Large}`, `{\LARGE LARGE}`,
118 `{\huge huge}` and `{\Huge Huge}`.
119
120 `\section{Formatting Environment}`
121 The formatting environment makes it possible to control the appearance
122 of the text. An environment is a section of the text in which an
123 indicated formatting feature is applied. The typeface changes
124 illustrated above is one example of environment change.

125 When curly brackets are typed `\emph{on both sides}` of a word with the
 126 `‘‘\emph{emphasis}’’` command (e.g. `\verb!\emph{emphasis}!`), the command
 127 is restricted to the text `\emph{within}` the braces. This is
 128 analogous to scoping aspects used in computer programming. Another
 129 way to create an environment is with `\verb!\begin{ }!` and
 130 `\verb!\end{ }!` commands, much in the same way that computer
 131 programmers use subroutines to transfer program control to
 132 libraries of subprograms. This process allows you to use preset
 133 environments for different types of lists, centered text, quotations,
 134 flush right and flush left text, mathematical symbols and equations,
 135 tabs, figures and tables.

136

137 `\section{Mathematical Symbols and Equations}`
 138 `\LaTeX{}` has powerful capabilities for formatting mathematical
 139 symbols, expressions and equations. Equations such as
 140 `\(R_m(A)=\prod_{j=1}^n(I-\omega_jA)\)` can be
 141 placed in a text line, or in ‘display’ mode:
 142 `\begin{equation}`
 143 `R_m(A)=\prod_{j=1}^n(I-\omega_jA)`
 144 `\end{equation}`
 145 `{\small`
 146 `\begin{verbatim}`
 147 1: `\begin{equation}`
 148 2: `R_m(A)=\prod_{j=1}^n(I-\omega_jA)`
 149 3: `\end{equation}`
 150 `\end{verbatim}}`

151

152 Displayed equations can have automatically generated equation
 153 numbers appear in the right (or left) margin. Another mathematical
 154 equation~\cite{pp.\ 73}{barrett94} feature is the capability to
 155 produce an array such as:

156 `\[`
 157 `B_k= \left(\begin{array}{cccccc}`
 158 `1 & -\beta_2 & & \cdots & 0 & \backslash`
 159 `& 1 & & -\beta_3 & & \vdots \backslash`
 160 `& \ddots & \ddots & \ddots & & \backslash`
 161 `\vdots & & \ddots & \ddots & -\beta_k & \backslash`
 162 `0 & \cdots & & & 1`
 163 `\end{array}\right).`
 164 `\]`

165 The `\LaTeX{}` source code of the above equation is as follows:

166 `{\small`
 167 `\begin{verbatim}`
 168 1: `\[B_k= \left(\begin{array}{cccccc}`
 169 2: `1 & -\beta_2 & & \cdots & 0 & \backslash`
 170 3: `& 1 & & -\beta_3 & & \vdots \backslash`
 171 4: `& \ddots & \ddots & \ddots & & \backslash`
 172 5: `\vdots & & \ddots & \ddots & -\beta_k & \backslash`
 173 6: `0 & \cdots & & & 1`
 174 7: `\end{array}\right). \]`
 175 `\end{verbatim}}`

176

177 Below, is an example of a multiline equation:

178 `\begin{Eqnarray*}`
 179 `\sum_{n=0}^{\infty} \left(-2\sinh^2\left(\frac{D2}{\right)}\right)^n`
 180 `\varphi &=& \frac{1}{1+2\sinh^2(D/2)} \varphi \backslash`
 181 `&=& \frac{1}{\cosh D} \phi`
 182 `\end{Eqnarray*}`

183 The source code is:

184 `{\small`
 185 `\begin{verbatim}`
 186 1: `\begin{Eqnarray*}`
 187 2: `\sum_{n=0}^{\infty} \left(-2\sinh^2\left(\right)`

```

188 3: \frac{D^2}{\varphi}
189 4: & = & \frac{1}{1+2\sinh^2(D/2)} \varphi \backslash
190 5: & = & \frac{1}{\cosh D} \varphi
191 6: \end{Equation*}
192 \end{verbatim}
193
194 In addition to its equation capabilities, \LaTeX{} can deliver
195 a large assortment of mathematical symbols, arrow symbols,
196 log-like function names, and equation
197 delimiters~\cite{lamport94, mittelbach04, nod94, prince09}.
198
199 \section{Other Document Tools}
200 \LaTeX{} can create figures and tables such as
201 Table~\ref{binary-mult} and Figure~\ref{fejer-kl}. It can
202 also create footnotes~\footnote{Footnote will wrap to
203 the following page if necessary.}and make cross-references.
204 The latter can be either forward or reverse references
205 to chapters, sections, tables, figures, equations and even
206 page numbers.
207 \begin{table}
208 \caption{Binary Multiplication}\label{binary-mult}
209 \begin{center}
210 \small
211 \begin{tabular}{r|rrrrr}
212 \hline\hline
213 \hfil $\times$ \hfil & 1 & 10 & 11 & 100 & 101 \\\
214 \hline
215 1 & 1 & 10 & 11 & 100 & 101 \\\
216 10 & 10 & 100 & 110 & 1000 & 1010 \\\
217 11 & 11 & 110 & 1001 & 1100 & 1111 \\\
218 100 & 100 & 1000 & 1100 & 10000 & 10100 \\\
219 101 & 101 & 1010 & 1111 & 10100 & 11001\\\
220 \hline
221 \end{tabular}
222 \end{center}
223 \end{table}
224
225 \begin{figure}
226 \centerline{%
227 \rotatebox{-90}{\includegraphics[height=8cm,clip]{fejer_kernel.eps}}}
228 \caption{Graph of the Fej\''{e}r kernel. This is a graph of
229 $F_5(u)$.\}\label{fejer-kl}
230 \end{figure}
231
232 %%%%%%%%%%% References %%%%%%%%%%%
233
234 \begin{thebibliography}{99}
235 \bibitem{barrett94}Barrett,~R. et al., ‘‘Templates for the Solution
236 of Linear Systems: Building Blocks for Iterative Methods,’’ SIAM, 1994.
237 \bibitem{lamport94}Lamport,~L., ‘‘\LaTeX{}: A Document Preparation
238 System,’’ Addison-Wesley Professional; 2nd Edition, 1994.
239 \bibitem{mittelbach04}Mittelbach,~F. et al., ‘‘\LaTeX{} Companion,’’
240 Add\~{i}son-Wesley Professional; 2nd edition, 2004.
241 \bibitem{nod94}Nodera,~T., ‘‘Easy Going \LaTeX,’’ (Japanese)
242 Kyoritu Pub., 2nd Edition, 1994.
243 \bibitem{prince09}Prince, T.~E. and Carnes, L.,
244 ‘‘\LaTeX{} Quick Start: A First Guide to Document
245 Preparation,’’ Personal \TeX{} Inc., 2009.
246 \bibitem{rasmussen11}Rasmussen,~J., ‘‘The Agile Samurai,’’ The
247 Pragmatic Bookshelf, 2010.
248 \end{thebibliography}
249 \end{document}

```