A Simple Guide to Latex/Lyx

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Preparation

Run the following commands in a *nix shell (do not enter prompt >):

```
> wget http://www.stat.rice.edu/~helpdesk/howto/lyxdemo.tar.gz
> tar zxf lyxdemo.tar.gz
```

`wget` is a useful command to grab something from the web. Using appropriate command options, it can download the whole web site (or only files of certain types) recursively. See `man wget` for details. `tar` command is used to uncompress and expand `.tar.gz` file. If you are using a windows machine, you can use a browser to download the file. Something like winRAR has to be used to uncompress the file.

The demo file `lyxdemo.tar.gz` contains the following files:

1. `demoarticle.tex` and `drawing.eps, demoarticle.ps,` a demo latex file with its output.

2. `essential.tex`, an excellent introduction to latex by *Jon Warbrick*.

3. `latexintro.pdf`, *The Not So Short Introduction to LATEX2e* by *Tobias Oetiker Hubert Partl, Irene Hyna and Elisabeth Schlegl.*

4. `Makefile`, a makefile to simplify the use of latex related commands

5. `latexsymbol.ps`, list of latex symbols

6. `lyxguide.lyx`, this file

7. `personal.bind` and `reference.lyx` , `reference.ps`, helpdesk lyx bind file with its reference

8. `demo.bib`, a sample bibtex file

Latex Basics

`demoarticle.tex` is the latex source file. You are supposed to input it (in whatever way you like). `demoarticle.ps` is one of the several possible outputs. You need to *compile* the source code to obtain it. Print and read `demoarticle.tex` and `demoarticle.ps` side by side and try to guess how the latex commands correspond to the output. It is important for you to understand

1. document class: the document class determines the overall layout of the document. Changing the document class will change *a lot* of your output layout.

2. environments (`\start{itemize}` and `\end{itemize}` etc)

3. difference between inline (`$$`) and displayed (`\[ \]`) formula.

4. `_`, `^` are for subscript and superscript.

5. `\sqrt, \sin, \alpha, \beta` are math symbols or functions

6. `\label` and `\ref`. `\label` is used to name an equation, section etc so that we can refer to them by `\ref`.

7. How tables and figures are included.

Latex commands

You should first prepare a `.tex` file, say `article.tex`, then

1. `latex article.tex`, obtain `article.dvi`

2. `xdvi artivle.dvi`, view the dvi file

3. `dvips article.dvi`, translate dvi to postscript format

4. `gv article.ps`, view ps file

5. `ps2pdf article.ps`, translate ps to pdf format

6. `acroread article.pdf`, view pdf file (`xpdf` can also be used.)

7. `pdflatex article.tex`, obtain a pdf file directly from .tex file

8. `latex2html article.tex`, translate the article to html format.

You can use a make file to simplify all these. (see sample make file `Makefile`). The commands will be simlified to `make view`, `make pdf`, `make web` etc. Note that there are many options for these commands which makes `make` especially useful.

Practice:

1. Try to understand every latex command. Use a editor, input the following formula: $E\left(e^{i\xi X}\right) = \int e^{i\xi x}dF(x)$..
   Hint: integral `\int`, subscript `_`, superscript `^`, ξ `\xi`, use `{}` to group items, use `\left( \right)` for big parenthesis and `()` for small parenthesis.

2. Compile and view `demoarticle.tex`.

3. Convert the dvi file to `ps` and `pdf` format and view them with appropriate viewers.

4. Modify `makefile` so that you can use `make view` etc to compile and view `essential.tex`.

5. Read `essential.ps` for a more detailed description of latex basics.

Start Lyx and set the bind file

Type

```
lyx
```

to start lyx. If this is the first time you run `lyx`, `lyx` will try to detect the latex settings and generate a `.lyx` directory under your home directory. This is where you put your personal settings. It is highly recommended that you use helpdesk bind file. It contains *a lot of* keyboard shortcuts for rapid input almost all important math symbols. To use helpdesk bind file, copy the provided bind file to `~/.lyx/bind`

```
cp ~/lyxdemo/personal.bind ~/.lyx/bind/
```

To activate this bind file, you will need to set `Edit -> Preference -> interface -> bind file -> Browse -> User bind -> personal.bind` and then restart lyx. Press `C-g b` (press `Control` and `g` keys, release both keys and then press b), if you can see β, the bind file is loaded correctly. Before you get used to all the shortcuts, it is a good idea to keep a copy of shortcut reference with you. (`reference.ps`)

Practice: Start and reconfigure lyx. Load helpdesk bind file. Print `reference.ps` and have a look at the key bindings.

Your First Lyx Document

Play with the menus for a while, guess what they mean. Then

1. start a new lyx file.

2. go to `Layout -> Document.` Choose `article (AMS)` as your document class since we will be using ams math package. Note that if you use the standard `article` class and `insert -> math -> case environment` or other AMS only environments, you will get compile errors. This is among the '*easiest ways to get compile errors of lyx*'. If this happens, you can either

   (a) change your document class to `ams` ones or,

   (b) `Layout -> Document -> Packages -> Use AMS Math`, or

   (c) put

      \usepackage{amsmath}

      in the preamble. (`layout -> Document -> preamble.`)

3. The leftmost drop list on the toolbar is the *environment list* (roughly the same as latex environments). Enter title, author, chapter, subchapter etc of the sample file and choose the right environment for them. Note that `Chapter*` is the non-numbered version of `Chapter` environment.

View your document

Save your file. Learn to

1. Use `View -> DVI` to view dvi output, `View -> PostScript` to view ps output. Lyx actually export the lyx file to latex and call `latex, xdvi, postscript` etc to do these. If you are interested in the underlying latex source, `File -> Export -> Latex` and read the generated latex file.

2. Modify your document and then `View -> update -> DVI`, `View -> Update -> PostScript` (you will need to reload the ps file from gv) to see updated output.

3. Learn shortcuts `F9, F10, F11, F12.`

Practice: Enter the first several paragraphs of the sample document.
Hint:

1. `F4, F5, F6` corresponds to normal, bold, emphasis fonts. (only for helpdesk bind file)

2. Use `C-M` to enter math mode. Use `arrow` or `blank` keys to get out.

Input Math Formula - basic inline formula

There are three ways to enter math mode: (fast to slow)

1. `Ctrl-M` (`Ctrl-M` means press the `Ctrl` and `M` keys at the same time. In `reference.tex,` `C` stands for `Control`, `S` stands for `shift` and `M` stands for `meta` (right `Alt` key for windows keyboard)), or

2. click the $\frac{a+b}{c}$ icon on the toolbar, or

3. `insert -> math -> inline formula`

To enter math symbols, you can either (slow to fast)

1. Use Math Panel (right click an existing formula or `insert -> math -> math panel ...`), or

2. In math mode, enter \ plus symbol name, e.g. enter `\alpha` for α, `\propto` for $\propto$. For symbol names, see `latexsymbol.ps`. or

3. Use shortcuts (see shortcut reference). For example, `C-g a` for α, `C-g r` for ρ, `C-s 1` for $\rightarrow$, `C-s i` for ∞. Basically, `C-g` means Greek character and `C-s` means symbol.

Character Accent:

1. Use math panel or

2. Use shortcuts `C-_,~,^` etc , e.g., `C-^ C-g a` inputs $\hat{\alpha}$. For wide accent (e.g. $\widehat{a+b}$) , use `Meta-_,~,^` instead.

Delimiters:
The sizes of ( ) may be small for math equations. The following delimiters are paired (so they are easier to input) and can change their sizes according to their context.

1. Use math panel or

2. Use `Ctrl + ( ) [ ] { } |` etc to input paired delimeters. Shortcuts for one side delimeters are also available.

Other important shortcuts:

1. `C-UpArrow` superscript, `C-DownArrow` subscript, I prefer `C-h/C-l` though.

2. `C-/` fraction, `C-s b` binomial, `C-s r` root

3. `C-s s` stack

Practice: Input formula: $\sqrt{n}\left(\frac{\bar{X}-\mu}{\sigma}\right) \xrightarrow{d} N(0,1)$.

Hint: `\sqrt` or `C-r` for $\sqrt{}$, `C-(` for (), `\sigma` or `C-s s` for σ, `C-_ X` for $\bar{X}$, `\mu` or `C-g m` for μ, `C-s s` for stack, `C-s 1` or `Alt-RightArrow` for $\rightarrow$.

Input Math Formula - displayed

All previous plus:

1. `C-d` for displayed formula. (helpdesk bindfile only)

2. `C-d` in inline/display formula will toggle between them.

3. If you prefer AMS align environments, `insert -> math -> AMS align environment` etc

4. In displayed formula, use `C-enter` to enter `equarray environment`. It is important to know that the middle cells are used for alignment purpose so only characters like $=$, $>$, $<$ etc are welcome. To add more lines, use `C-Enter` at the end of a line.

5. `Insert -> label` to name a formula, then use `insert -> cross reference` to refer to it. Use `C-n`, `C-N` to toggle numbering.

Important Usuage hints:

1. In math mode, use `C-M` to enter text mode. (If you know latex, it is `$ \text{ } $`.) Then, you *can not* use C-M again to enter math mode within the text mode. Use right-arrow to *step out* of the text mode. ***You will get compile error if you input math symbols in text mode.***

2. `C-s c` for 2 cases, `C-s C` for 3 cases. (need ams package and helpdesk bindfile)

3. `C-s m` for 2 by 2 matrix, `C-s M` for 3 by 3 matrix, `C-s C-m a b` for `a` by `b` matrix.

4. use `Edit -> math` to add/delete row, column of a matrix or change alignment.

5. Sometimes, you will need one side delimiter, use math panel or shortcuts.

Practice: Input formula:

$$
\begin{aligned}
x &= \begin{cases} \frac{1}{n} & \textbf{w.p. } \frac{1}{n} \\ n & \textbf{w.p. } 1 - \frac{1}{n} \end{cases} \\
y &= x^2
\end{aligned}
$$

Hint: '=' should be in the middle cell of the equarray. You can use either `insert -> math -> case environment` or one side dilimiter { (`C-s {`) and then a 2 by 2 matrix. Use `C-M` to toggle between text/math mode (for text w.p.) and `edit -> math` to change alignment, if necessary.

Figure and Table

It is time to mention two ways of organizing tables and figures. The first one is fixed. The tables or figures will be put where you insert them. If there is not enough room in the current page, it will be put to the next page but the rest of the current page will be left blank. Floating tables and figures are designed to overcome this problem. They will be put automatically according to a complex machanism to achieve best layout.

To insert fixed table/figure:

    insert -> tabular material insert -> Graphics

To insert floating table/figure:

    insert -> floats -> table/figure,

then `insert -> table/graphics` within the floating box.

To set the floating preferences, right click the red 'float' box. Usually, you need to set size and rotate propertiies.

Spell Checker

In plain latex, it is rather difficult to use a spell checker. Now, you can use `edit -> spellchecker.`

Nested Environment

The concept of 'depth' of an environment is important. Two very import shortcuts to remember are `C-Left/RightArrow,` or equivalently `Layout -> Change environment depth.` To make depth adjustment easier,

1. There are many differnt 'enter's. `Alt-Enter` will keep environment type and depth. `Ctrl-enter` will break line but do not break paragraph, enter will break paragraph and go to depth 1.

2. standard is also an environment (different from plain latex) . For example, you want to insert a centered table within a enumerate environment, start a paragraph, select as `standard` environment, use `C-RightArrow` to make it one depth higher than the `enumerate` environment and then choose `layout -> paragraph -> center.`

3. If you use environment change a lot, it is time to learn shortcuts `C-p T` (title), `C-p s` (standard), `C-p 2, 3,4,` (section, subsection etc).

Advanced Topic: Latex code, ERT and preamble.

1. If you know latex pretty well and know how to do something quicker in plain latex, do so. Click the red TeX botton on the toolbar, enter appropriate latex comand. The text will be in red so it is called Evil Red Text (ERT). E.g. you can use ERT `$x^2$` to input x^2. One popular ERT is

   `\vspace{1in}`

2. If you have a big trunk of plain latex code, you can include them directly in your lyx file through ERT. Anyway, if you have a full latex file, importing it into lyx would be better.

3. If you need to set preamble (read `latexinto.pdf` to see what preamble is), use `Layout -> Preamble`. Useful preambles include

   `\usepackage{amsmath}`
   `\numberwithin{thm}{section}`

   the first one include amsmath package (in case that you do not use ams class.) The second one control how the equations will be numbered.

Advanced Topic: Insert Source Code

If you would like to include your source code into lyx, you can

1. `insert -> float -> algorithm`

2. set caption

3. copy the source code from emacs etc

4. select `lyx Code` environment

5. `Edit -> paste extenal selection -> as lines.`

Advanced Topic: Citation and Bibliographics

I would suggest the following way of dealing with bibliographic item.

1. Keep your bibs in a separate bibtex file. (see `sample.bib` file)

2. use `tkbibtex` to edit the bib files. Try to keep track of all articles you have read in this way. (Jabref may be easier to use under windows).

3. In lyx, `insert -> Lists & TOC -> Bibtex reference` at the end of the document. Enter the path to your bib file, do not change the style (default as `plain`) if you do not know other styles. If you do, `plainnat, natbib` (`layout -> document -> bibliographics -> use natlib`) will be helpful.

4. `Insert -> citation reference`, use arrow in the dialog to insert citation.

Lyx (actually latex) will take care of everything else for you. Note that you can use ERT `\nocite{*}` to insert bib items into your document without actually cite them.

Practice: Using sample.bib, insert a citation into your lyx file.

Advanced Topic: Import/Export latex file

`File -> Export -> Latex` will export your lyx file to `.tex` file. `File -> import -> Latex` can import most of the 'clean' latex files. However, because of the complexity of latex, lyx can not load very complicated latex files, especially when they use non-standard document style, lots of macros etc. It is advised that you use lyx from the beginning rather than import a half-done latex file. If lyx fails to import your tex file, try to hand-clean it before you import it to lyx.

Practice: Export your lyx file to latex and have a look at it. Then import it into lyx again.

Advanced Topic: Key bindings

Lyx uses a key-binding file to determine the key-bindings at start time. You can choose from Emacs, SWP, CUA style by specifying the appropriate file at:

    Edit -> Preferences -> Look and Feel -> Interface -> Bind
    File

You can add your own key bindings by

1. copying a system binding file to ˜/.lyx/bind

2. Modify it.

3. Set this bind file in preference dialog

The syntax of bind file is pretty easy, here is a few example:

```
\bind "C-f" "math-insert \frac"
\bind "F5" "font-bold"
```

The first line binds `Ctrl-f` to `\frac` (fraction). The second one maps `F5` to `font-bold` as SWP does. For more examples, have a look at the system bind files at `/usr/site/lyx/share/lyx/bind` or my personal bind file.

Practice: Open ˜/.lyx/bind/personal.bind, insert a keybinding that bind C-s h to \aleph (ℵ). Save personal.bind, restart lyx, try to insert ℵ.

Advanced Topic: Export to HTML

You can use insert -> URL to insert a URL. However, if you export -> html (or view html), there will be no html style link. This is not lyx's fault since there is no standard way of dealing link in latex. I, however, figure out a patch to do this.

1. Save your lyx file, say article.lyx

2. /home/helpdesk/bin/lyx2tex article.lyx

3. latex2html article.tex

Basically, I modify the lyx file a little bit to let it create 'latex2html' style link so that latex2html can recognize and create real links. It would be convenient to use the provided make file.

Advaced Topic: Pitfalls about lyx

Lyx is not perfect. It has many problems that may irritate even experienced users, and you will sooner or later meet some. Fortunately, lyx is becoming better and better and its user mailing list is very friendly. (I am in that list, you can always send me questions and if I can not answer them, I will post them to the list.) Certain precautions should be made

1. Compile (press F11) frequently, if any error occurs (latex compile error), you know you made the mistake in recently input texts.

2. If the problem persists, export to latex and try to see what forbid latex from compiling. This is where latex knowledge becomes very useful. Anyway, if you can avoid the following two common problems, you can use lyx for a long time without having to face compile error:

   (a) use AMS package when you input AMS-specific environments like cases, align etc.

(b) do not enter math symbol in text mode. (Use right-arrow to step out of text mode instead of using nested math mode.)

3. Latex output is in general beautiful. However, you will run into trouble if you want to do fancy things like putting a logo on every page etc. (It is doable but needs the right, if not lots of, latex code.) You can find a lot of such tricks from lyx webpage.

4. You might need to use some other style (class) file. For example, you will need to write your thesis with some provided class file. It is possible to incorporate outside layout file into lyx but it would be simpler to export your lyx file to latex and modify it (especially when your advisor does not use lyx.)

Advanced Topic: Windows version of lyx

Since lyx depends on various Unix tools and the X-windows system, you will have to provide all of them on your windows machine before lyx can be installed. That is to say, you will have windows version of latex (teTEX), of Unix (Cygwin), of X (X-win32 or Xfree86), of ghostview etc. Detailed instructions can be googled through "lyx windows". There is recently a native lyx port that may be easier to install.