

L^AT_EX Debugging, Engines and Distributions*

Boris Veytsman

February 2009

L^AT_EX Compilation

Log Files

Debugging with Logs

Engines, Formats, . . .

Classes and Packages

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Editors and Front Ends



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1. L^AT_EX Compilation

We found ([Lecture 1](#)) that a L^AT_EX file is a program. What is the output of this program? What is the compiler?

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1. L^AT_EX Compilation

We found ([Lecture 1](#)) that a L^AT_EX file is a program. What is the output of this program? What is the compiler?

The output is the typeset pages on screen or on paper. The compiler is (usually) either `latex` or `pdflatex`.

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1. L^AT_EX Compilation

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The output is the typeset pages on screen or on paper. The compiler is (usually) either `latex` or `pdflatex`.

`file.tex`

1. `file.tex`—L^AT_EX program.

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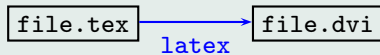
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1. `file.tex`—L^AT_EX program.
2. `file.dvi`—Device Independent format. Can be viewed with `xdvi`, `WinDVI`...

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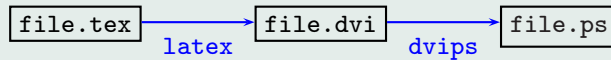
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The output is the typeset pages on screen or on paper. The compiler is (usually) either `latex` or `pdflatex`.



1. `file.tex`—L^AT_EX program.
2. `file.dvi`—Device Independent format. Can be viewed with `xdvi`, `WinDVI`...
3. `file.ps`—PostScript file. Can be viewed with `gs` or sent to printer.

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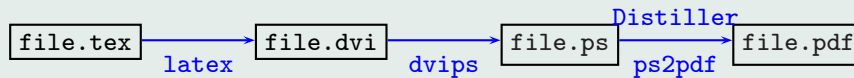
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1. L^AT_EX Compilation

We found ([Lecture 1](#)) that a L^AT_EX file is a program. What is the output of this program? What is the compiler?

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2. `file.dvi`—Device Independent format. Can be viewed with `xdvi`, `WinDVI`...
3. `file.ps`—PostScript file. Can be viewed with `gs` or sent to printer.
4. `file.pdf`—Adobe PDF.

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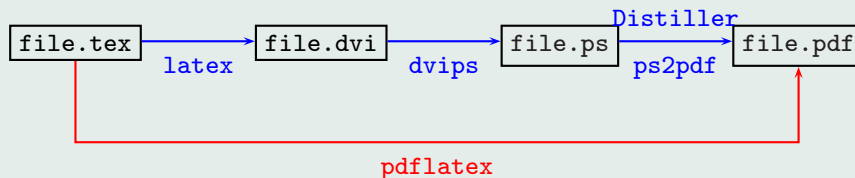
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1. L^AT_EX Compilation

We found ([Lecture 1](#)) that a L^AT_EX file is a program. What is the output of this program? What is the compiler?

The output is the typeset pages on screen or on paper. The compiler is (usually) either `latex` or `pdflatex`.



1. `file.tex`—L^AT_EX program.
2. `file.dvi`—Device Independent format. Can be viewed with `xdvi`, `WinDVI`...
3. `file.ps`—PostScript file. Can be viewed with `gs` or sent to printer.
4. `file.pdf`—Adobe PDF.

Main difference: graphics!

“Traditional” route: You can use graphics in EPS or PS formats. You can use PSTricks.

Alternative route: You can use graphics in JPG, PNG, PDF format. You can include JavaScript. PSTricks is difficult—but possible.

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2. Log Files

T_EX tells us a lot about its work. It is written to the file `.log`. If you are going to debug your files, you need to understand it!

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Let us return to our example

simple.tex

```
\documentclass[12pt]{article}

\begin{document}

Hello, World!

This is our first document. We would like to tell the world two
interesting facts: first, that  $2 \times 2 = 4$ , and second, that
\begin{equation}
E=mc^2
\end{equation}

\end{document}
```

Exercise 1. Compile the file `simple.tex` and look at the log.



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2.1. Banners

```
This is pdfTeX, Version 3.141592-1.30.5-2.2 (Web2C 7.5.5)
  (format=pdflatex 2007.4.18)  7 FEB 2009 13:36
entering extended mode
**simple
```

We see which T_EX engine is used, and which *format* (pre-set collection of macros) was employed. We see the file which is processed.

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2.2. Reading Files

```
(./simple.tex
LaTeX2e <2005/12/01>
Babel <v3.8c> and hyphenation patterns for english, usenglishmax,
  dumylang, nohyphenation, ukrainian, russian, bulgarian, loaded.
(/usr/share/texmf-add/tex/latex/base/article.cls
Document Class: article 2005/09/16 v1.4f Standard LaTeX document class
(/usr/share/texmf-add/tex/latex/base/size12.clo
File: size12.clo 2005/09/16 v1.4f Standard LaTeX file (size option))
```

We have read three files: `simple.tex` (our file), and two system files: `article.cls` and `size10.clo`. They determine appearance of the result.



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2.2. Reading Files

```
(./simple.tex
LaTeX2e <2005/12/01>
Babel <v3.8c> and hyphenation patterns for english, usenglishmax,
  dumylang, nohyphenation, ukrainian, russian, bulgarian, loaded.
(/usr/share/texmf-add/tex/latex/base/article.cls
Document Class: article 2005/09/16 v1.4f Standard LaTeX document class
(/usr/share/texmf-add/tex/latex/base/size12.clo
File: size12.clo 2005/09/16 v1.4f Standard LaTeX file (size option))
```

We have read three files: `simple.tex` (our file), and two system files: `article.cls` and `size10.clo`. They determine appearance of the result.

Exercise 2. What versions of `article.cls` and `size10.clo` does the system use? When were they written?



2.3. Counters Allocation

```
\c@part=\count79
\c@section=\count80
\c@subsection=\count81
\c@subsubsection=\count82
\c@paragraph=\count83
\c@subparagraph=\count84
\c@figure=\count85
\c@table=\count86
\abovecaptionskip=\skip41
\belowcaptionskip=\skip42
\bibindent=\dimen102
```

You probably do not need this stuff unless you are a wizard.



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2.3. Counters Allocation

```

\c@part=\count79
\c@section=\count80
\c@subsection=\count81
\c@subsubsection=\count82
\c@paragraph=\count83
\c@subparagraph=\count84
\c@figure=\count85
\c@table=\count86
\abovecaptionskip=\skip41
\belowcaptionskip=\skip42
\bibindent=\dimen102
  
```

You probably do not need this stuff unless you are a wizard.

2.4. Reading And Writing Auxiliary File

```

) (./simple.aux)
\openout1 = 'simple.aux'.
  
```

\LaTeX uses *auxiliary files* for its numbering and cross-references. Here we read and write `simple.aux`



2.5. Fonts

```
LaTeX Font Info: Checking defaults for OML/cmm/m/it on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: Checking defaults for T1/cmr/m/n on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: Checking defaults for OT1/cmr/m/n on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: Checking defaults for OMS/cmsy/m/n on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: Checking defaults for OMX/cmex/m/n on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: Checking defaults for U/cmr/m/n on input line 3.
LaTeX Font Info: ... okay on input line 3.
LaTeX Font Info: External font 'cmex10' loaded for size
(Font) <12> on input line 8.
LaTeX Font Info: External font 'cmex10' loaded for size
(Font) <8> on input line 8.
LaTeX Font Info: External font 'cmex10' loaded for size
(Font) <6> on input line 8.
```

Even if your text uses just one font, some standard families are loaded anyway.

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2.6. Shipping Out Pages

```
[1]
(./simple.aux) )
```

This says that we have one page ([1]) and wrote `simple.aux`

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2.6. Shipping Out Pages

```
[1]
(./simple.aux) )
```

This says that we have one page ([1]) and wrote `simple.aux`

2.7. Memory Allocation

```
Here is how much of TeX's memory you used:
219 strings out of 94960
2308 string characters out of 1182132
47674 words of memory out of 1000000
3451 multiletter control sequences out of 10000+50000
6376 words of font info for 23 fonts, out of 500000 for 2000
212 hyphenation exceptions out of 8191
22i,4n,19p,122b,107s stack positions out of 1500i,500n,5000p,200000b,5000s
```

Again stuff for wizards. . .



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2.8. Finishing Touch

```
Output written on simple.dvi (1 page, 596 bytes).
```

This should be self-explanatory.

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2.8. Finishing Touch

```
Output written on simple.dvi (1 page, 596 bytes).
```

This should be self-explanatory.

Exercise 3. Compile `simple.tex` with `pdflatex`. What changes in the log?

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3. Debugging with Logs

Let us now make an error in our file:

```
error1.tex
\documentclass{article}

\begin{document}

This is a very simple document

\end{document}
```

Exercise 4. Where is the error in this file?

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3. Debugging with Logs

Let us now make an error in our file:

```
error1.tex
\documentclass{article}

\begin{document}

This is a very simple document

\end{document}
```

Exercise 4. Where is the error in this file?

Exercise 5. Compile the file.



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```
! LaTeX Error: Environment document undefined.
```

```
See the LaTeX manual or LaTeX Companion for explanation.
```

```
Type H <return> for immediate help.
```

```
...
```

```
1.3 \begin{document}
```

```
? Q
```

LaTeX found an error on line 3.


```
! LaTeX Error: Missing \begin{document}.
```

See the LaTeX manual or LaTeX Companion for explanation.

Type H <return> for immediate help.

...

1.5 T

his is a very simple document

You're in trouble here. Try typing <return> to proceed.

If that doesn't work, type X <return> to quit.

Our troubles continue: L^AT_EX does not see `\begin{document}` and cannot figure out the text on line 5 . This is common in T_EX (or any programming environment): an early error makes ripples.



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```
[1
]
! I can't find file 'error1.aux'.
\enddocument ...makeatletter \input \jobname .aux
\fi \dofilelist \ifdim \f...
1.7 \end{document}

Please type another input file name
! Emergency stop.
\enddocument ...makeatletter \input \jobname .aux
\fi \dofilelist \ifdim \f...
1.7 \end{document}

*** (job aborted, file error in nonstop mode)
```

Now the system is hopelessly befuddled.



```
[1
]
! I can't find file 'error1.aux'.
\enddocument ...makeatletter \input \jobname .aux
                                \fi \@dofilelist \ifdim \f...
1.7 \end{document}

Please type another input file name
! Emergency stop.
\enddocument ...makeatletter \input \jobname .aux
                                \fi \@dofilelist \ifdim \f...
1.7 \end{document}

*** (job aborted, file error in nonstop mode)
```

Now the system is hopelessly befuddled.

Important Lesson: Everything after an error can be a gibberish.

Let us make another error:

error2.tex

```
\documentclass{article}

\begin{document}

This is a very simple document

\END{document}
```

Exercise 6. Where is the error in this file?

Exercise 7. Compile this file.



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```
! Undefined control sequence.
1.7 \END
      {document}
? Q
OK, entering \batchmode...
)
! Emergency stop.
<*> error2.tex

*** (job aborted, no legal \end found)
```



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```
! Undefined control sequence.
1.7 \END
      {document}
? Q
OK, entering \batchmode...
)
! Emergency stop.
<*> error2.tex

*** (job aborted, no legal \end found)
```

Exercise 8. L^AT_EX here found two errors rather than one error. Describe both.



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4. Engines, Formats, Distributions

- What kind of car do you have?
- I have a Ford. And you?
- I have an SUV.

Exercise 9. What's wrong with this dialogue?

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4. Engines, Formats, Distributions

- What kind of car do you have?
- I have a Ford. And you?
- I have an SUV.

Exercise 9. What's wrong with this dialogue?

4.1. T_EX Engines

Our log file starts with

```
This is pdfTeX, Version 3.141592-1.30.5-2.2 (Web2C 7.5.5)
```

This is T_EX engine.

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4. Engines, Formats, Distributions

- What kind of car do you have?
- I have a Ford. And you?
- I have an SUV.

Exercise 9. What's wrong with this dialogue?

4.1. T_EX Engines

Our log file starts with

```
This is pdfTeX, Version 3.141592-1.30.5-2.2 (Web2C 7.5.5)
```

This is T_EX engine.

A bit of history. Knuth wrote his engine:

```
This is TeX, Version 3.141592 (Web2C 7.5.5)
```

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4. Engines, Formats, Distributions

- What kind of car do you have?
- I have a Ford. And you?
- I have an SUV.

Exercise 9. What's wrong with this dialogue?

4.1. T_EX Engines

Our log file starts with

```
This is pdfTeX, Version 3.141592-1.30.5-2.2 (Web2C 7.5.5)
```

This is T_EX engine.

A bit of history. Knuth wrote his engine:

```
This is TeX, Version 3.141592 (Web2C 7.5.5)
```

Exercise 10. Find the differences with the previous banner!

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Hàn Thố Thành wrote `pdftex`—which can produce *both* DVI and PDF files. Then his work was joined with another “extended” engine: `ε-tex`, giving `pdfetx`. Nowadays both `latex` and `pdflatex` use `pdfetx`.

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Some other engines:

`xetx`: First written for Mac, it tries to use system fonts.

`luatex`: Adds Lua extensions.

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Some other engines:

`xetx`: First written for Mac, it tries to use system fonts.

`luatex`: Adds Lua extensions.

All engines¹ in the compatibility mode give *exactly same result*. (up to 10¹⁰).

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¹except newer experimental `luatex`

4.2. Formats

Format is the system built on the top of T_EX. Our format is LaTeX2e <2005/12/01>.

Some other formats:

plain T_EX: Original format by Knuth. Many people still use it.

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4.2. Formats

Format is the system built on the top of T_EX. Our format is LaTeX2_ε <2005/12/01>.

Some other formats:

plain T_EX: Original format by Knuth. Many people still use it.

AMS-T_EX: Format for American Mathematical Society by Spivak. Now most people use L^AT_EX 2_ε with AMS-L^AT_EX extensions instead.

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L^AT_EX2.09: The obsolete L^AT_EX format (before L^AT_EX2_ε). Was very popular before 1994.



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4.2. Formats

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L^AT_EX2.09: The obsolete L^AT_EX format (before L^AT_EX2_ε). Was very popular before 1994.

L^AT_EX3: The proposed future of L^AT_EX. Nobody have seen it yet²



²You can donate to L^AT_EX3 team to facilitate their work. See <http://www.tug.org>

4.2. Formats

Format is the system built on the top of T_EX. Our format is L^AT_EX2_ε <2005/12/01>.

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L^AT_EX2.09: The obsolete L^AT_EX format (before L^AT_EX2_ε). Was very popular before 1994.

L^AT_EX3: The proposed future of L^AT_EX. Nobody have seen it yet²

ConT_EXt: A new and interesting format, written from scratch.



²You can donate to L^AT_EX3 team to facilitate their work. See <http://www.tug.org>

5. Classes and Packages

L^AT_EX uses classes and packages to set up the appearance. Sometimes their number is small

```
Document Class: article 2005/09/16 v1.4f Standard LaTeX document class
(/usr/share/texmf-add/tex/latex/base/size12.clo
File: size12.clo 2005/09/16 v1.4f Standard LaTeX file (size option))
```

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Sometimes it is large:

```
(/usr/share/texmf-add/tex/latex/texpower/tpslifonts.sty
Package: tpslifonts 2004/07/27 v0.6d Configure presentation fonts.
(/usr/share/texmf-add/tex/latex/base/ifthen.sty
Package: ifthen 2001/05/26 v1.1c Standard LaTeX ifthen package (DPC)
)
(/usr/share/texmf-add/tex/latex/ps4pdf/ps4pdf.sty
Package: ps4pdf 2005/02/11 v0.6i PS code for pdfTeX (RN/HO)
(/usr/share/texmf-add/tex/latex/graphics/keyval.sty
Package: keyval 1999/03/16 v1.13 key=value parser (DPC)
\KV@toks@=\toks14
)
...
```

Their versions change. Sometimes it is relevant. For *standard* classes mostly not. For third party packages—mostly yes. We will talk about this later.



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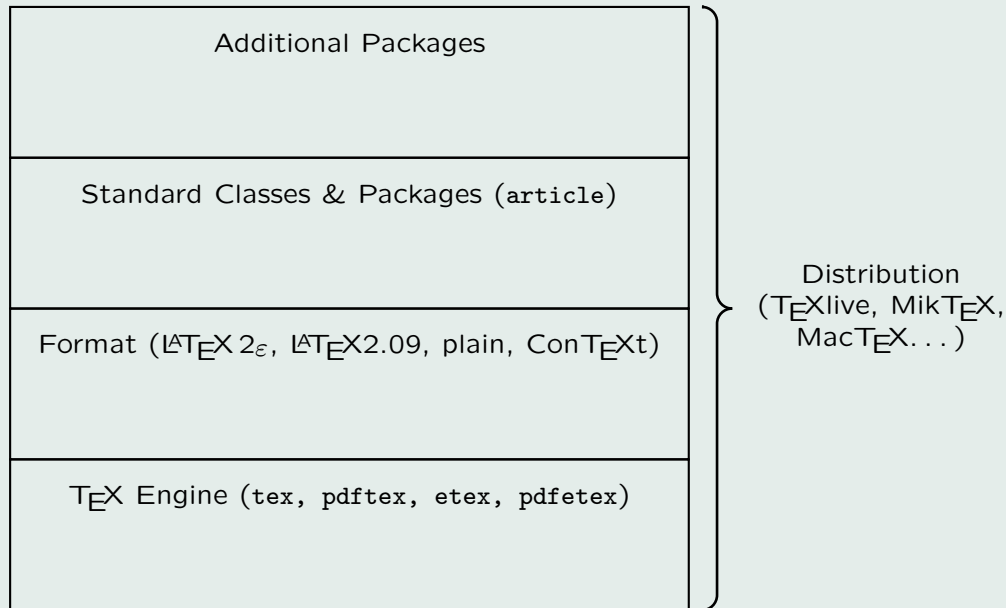
Print

Quit

6. Distributions

Distribution: a collection of the engine, other programs, formats, classes, files, etc.

Popular distributions: \TeX live (Unix, Linux, Windows, Mac), Mik \TeX (Windows), Mac \TeX (Mac) and many others.



7. Editors and Front Ends

You *can* use any text editor like *Notepad* or *pico*. But you may want to make your life simpler.

A T_EX-aware editor can help!

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Help with errors: automatically go to the next error.



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Mac OS X: T_EXShop

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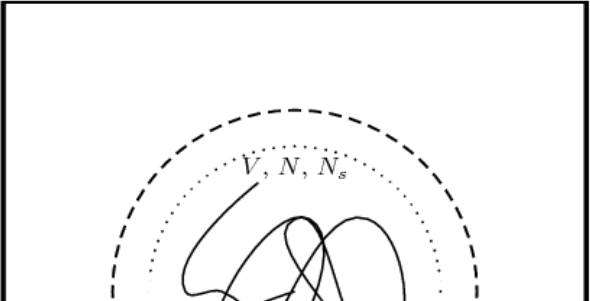
Quit

Front End: a quasi-WYSWYG approach. Emacs (with preview package),
Lyx, Scientific Word, etc.

File Edit Options Buffers Tools Preview LaTeX Command Ref Help

Then only terms left describe the interactions between the molecules and the elastic entropy of the polymer chain. We will estimate these terms in the mean field approximation.

In this approximation we will choose the volume V on Figure~\ref{fig:chain} in such way that it does not include pure solvent, but only the chain and the solvent interacting with the chain (Figure~\ref{fig:tighten}). Moreover, we will assume that the volume fraction Φ of polymer inside the volume is constant. Then we can write

$$\Phi = \frac{Nv}{V} \quad (10)$$


-- 01_flory.tex 45% L184 CVS-1.8 (LaTeX Ref Fill)---3:20---

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