

Introduction to $\text{T}_{\text{E}}\text{X}/\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$
UIUC Department of Mathematics
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1 What is $\text{T}_{\text{E}}\text{X}$?

$\text{T}_{\text{E}}\text{X}$ is a program for high quality technical typesetting, created in the early 1980s by Stanford Computer Science Professor Don Knuth. It has become the de facto standard for typesetting documents in mathematics and related fields. Virtually all research level books and journals in mathematics now are produced in $\text{T}_{\text{E}}\text{X}$ (usually using author-generated files), all recent theses in this department have been prepared in $\text{T}_{\text{E}}\text{X}$, and it is common to see $\text{T}_{\text{E}}\text{X}$ snippets in email correspondence among mathematicians and postings to mathematical newsgroups and mailing lists. Aside from its use in research level publication, $\text{T}_{\text{E}}\text{X}$ is also useful in a classroom setting, e.g., to produce exams, quizzes, homework solutions, lecture notes, and other class handouts.

2 What is $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$?

$\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ is a superset of $\text{T}_{\text{E}}\text{X}$, created in the mid 1980s by Leslie Lamport. As an extension of $\text{T}_{\text{E}}\text{X}$, $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ can do everything that $\text{T}_{\text{E}}\text{X}$ does, but it also provides a comprehensive set of high level macros to facilitate typesetting of structured documents and automate such things as section and equation numbering, or matching citations to references in the bibliography. $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ is one of a number of $\text{T}_{\text{E}}\text{X}$ “dialects” that have been created over the years, but

it is the only that has stood the test of time and now dominates the market¹. Virtually all $\text{T}_{\text{E}}\text{X}$ produced these days is in the $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ flavor. **Henceforth, when referring to $\text{T}_{\text{E}}\text{X}$, I always mean the $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ incarnation².**

3 Do I need to learn $\text{T}_{\text{E}}\text{X}$?

As a graduate student, you will sooner or later have to learn $\text{T}_{\text{E}}\text{X}$, at the very latest when you are starting to write your thesis. Having a working knowledge of $\text{T}_{\text{E}}\text{X}$ is a must for professional mathematicians in an academic environment, and anyone aspiring to be such. You might also find $\text{T}_{\text{E}}\text{X}$ useful in your teaching, and you might even find—as I do—working with $\text{T}_{\text{E}}\text{X}$, solving $\text{T}_{\text{E}}\text{X}$ nic challenges you come across, and seeing the results of your efforts in the form of good looking, professional quality documents, a rewarding experience.

That said, you don't have to jump into $\text{T}_{\text{E}}\text{X}$ right away. As a beginning graduate student, you have plenty of other things to worry about. Learning $\text{T}_{\text{E}}\text{X}$ can wait till your academic life has quieted down a bit. Also, you should allow yourself plenty of time to learn $\text{T}_{\text{E}}\text{X}$ properly—otherwise you'll likely end up acquiring bad habits that are hard to shed and in the end will cost you in terms of time wasted on doing things inefficiently, or in terms of inferior quality output caused by bad coding practices.

4 How do I get started with $\text{T}_{\text{E}}\text{X}$?

As a graduate student, you have an account on the UIUC Math Department's Unix network, and access to the Sun workstations in the computer labs (130AH and B1 Coble) and offices. I would strongly recommend using

¹The only other $\text{T}_{\text{E}}\text{X}$ dialect that, for a period of time, was widely used, is $\mathcal{A}\mathcal{M}\mathcal{S}\text{T}_{\text{E}}\text{X}$, created by the American Mathematical Society (AMS). However, with $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ emerging as the dominant $\text{T}_{\text{E}}\text{X}$ flavor during the past decade, $\mathcal{A}\mathcal{M}\mathcal{S}\text{T}_{\text{E}}\text{X}$ has become nearly obsolete, and its use is discouraged, even by the AMS, which had been the driving force behind $\mathcal{A}\mathcal{M}\mathcal{S}\text{T}_{\text{E}}\text{X}$. For its own publications, the AMS strongly recommends using $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$, in conjunction with special “packages” created by the AMS.

²More specifically, $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X} 2_{\varepsilon}$, the current version of $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$, created in the early 1990s. The previous version, $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X} 2.09$, is essentially obsolete, though one still occasionally sees papers prepared in that older format. Our $\text{T}_{\text{E}}\text{X}$ installation is current, and typing `latex` will automatically give you the newer ($\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X} 2_{\varepsilon}$) version. If for some reason, you really want the old version, you can get it by using the command `latex209` instead.

these machines rather than a home computer or laptop, since these machines have everything you need already installed—a current and comprehensive T_EX installation, editors (vi/vim, and emacs), and other useful utilities.

If you have no prior experience with T_EX, here is what I’d recommend to get started.

1. **Make sure you have some basic knowledge of Unix commands.** Since you will be doing your work in a Unix environment, you should be familiar with the basic Unix commands for moving around the file system, changing directories, listing files, etc.
2. **Make sure you are reasonably proficient with one of the standard Unix text editors, vi/vim or emacs.** Which one you choose is a matter of personal preferences. It’s hard to switch back and forth between the two, so if you are already familiar and comfortable with one of these, stick with it. Personally, I use vi (or rather vim, an enhanced version of vi), but that’s simply because I grew up with vi. For beginners, emacs is probably the better choice because it comes with extensive help pages and tutorials and has a shorter learning curve. Emacs has a “tex mode” that facilitates writing T_EX code, e.g., by coloring or highlighting key words or macros, and by doing some basic syntax checking. Vim—but not the original vi program—has a similar feature, though it is harder to set up.
3. **Work through the “Introduction to LaTeX” course (online at <http://www.math.uiuc.edu/~hildebr/tex/course>).** This is a three hour course that I created in 2001 for the participants at an Undergraduate Summer Research (REU) Program and which has since been used by other instructors. It is essentially a self-study course and in principal is self-contained, but it would help to have a reference like “Math into LaTeX” by George Gratzer (see below) handy when working through that course. Keep in mind that this course is a crash course intended to get you started in relatively little time, but it is not sufficient to give you the level of T_EX proficiency needed, for example, to write a thesis.
4. **Work through Chapter I (“Short Course”) of the book “Math into LaTeX” by George Gratzer.** This chapter provides a more comprehensive introduction to L^AT_EX and is an ideal follow-up to the three hour “crash course” mentioned above. The chapter (though

not the most recent edition) is available online for free at <http://www.ctan.org/tex-archive/info/mil/mil.pdf>. However, I'd recommend purchasing your own copy of this book at this point, as you will need this book sooner or later anyway. Gratzner's book is, by far, the best and most appropriate introductory text on \LaTeX because of its focus on **mathematical** typesetting. It is also quite complete and useful as a general reference on \LaTeX , and for most people Gratzner's book is the only one they need.

5. **Practice your \TeX skills.** Once you have acquired basic \TeX knowledge, it's time to practice your skills and gain more experience. A good way to do so is by gradually incorporating \TeX into your teaching and class work, and using \TeX for exams, class handouts, and homework solutions. While doing this, keep a copy of Gratzner's book at hand and consult it whenever you are in doubt about how to do some specific typesetting task. Also check out my "LaTeX Tips" pages (online at <http://www.math.uiuc.edu/~hildebr/tex/>, printouts available in 130 Altgeld) for further tips and pointers. These tips pages are intended to complement standard books and reference works by focusing on items not well covered in books and on common mistakes.

Make sure you do things "by the book". At this stage you have enough \TeX knowledge that you could handle most typesetting tasks on your own, without further consulting books and references, and it is tempting to do just that. This, however, would be a mistake. If you come across something you have never encountered before, do not try to find a "solution" on your own, but instead check Gratzner's book to see if the situation is covered there. Any fixes you might come up with on your own are likely inferior to the "book solutions", and while they may not cause immediate problems when compiling the code, they will probably result in poorly looking output. Moreover, by continuing to do things your own way, you will acquire bad coding habits that are hard to shed and which, aside from leading to inferior looking \TeX output, will end up costing you time from using inefficient and wasteful coding techniques. **Thus, whenever you come across something you have never seen or handled before (say, a summation involving a multiline summation condition), check Gratzner's book to see if it is covered there, rather than trying to invent a solution on your own.**

5 Resources

Here is a brief list of resources available to local students and faculty:

- **Introduction to LaTeX**, <http://www.math.uiuc.edu/~hildebr/tex/course>. The online version of the LaTeX “crash course” mentioned above.
- **Books**. The computer lab in 130 AH has copies of some T_EX books, including Gratzner’s “Math into LaTeX”, that you can consult if needed. Please do not take these books out of the room.
- **T_EX Tips and Resources**, <http://www.math.uiuc.edu/~hildebr/tex>. This page contains links to the LaTeX Tips pages mentioned above, UIUC thesis style files, and links to general resources. Of particular interest is the very comprehensive “TeX FAQ” by the UK T_EX Users Group.
- **Help**. You can send send T_EX questions to “texhelp”, or just stop by at my office in 241 Illini Hall (I’m in most of the time). The texhelp address is just an alias for me (hildebr), so email sent to texhelp will end up in my mailbox. I’m happy to answer questions, and I enjoy the challenge of solving a hard T_EX problem, but I am doing this on my own time, so please be sure to first check the tips pages and the Gratzner book to see if your question isn’t answered there. Also, such help limited to local users. Finally, I cannot help with problems you may have installing or running T_EX on your own computer. As mentioned above, I would recommend to do your T_EX work on the departmental Unix machines (or by logging into your account via ssh). This is what I have been doing for years, I am happy with what is available on the departmental network, I have never felt a need for having a separate T_EX installation on a personal machine, and I have no experience with such installations.
- **Coming soon**. In the coming months, I plan to add material to my T_EX Resources page, such as templates and sample files. I also plan to launch, early in the fall semester (hopefully), a “TeX Tip of the Week” series. Stay tuned for announcements!