
Giving it away

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In the early 90s I wrote an undergraduate textbook. Inspired by the tools used to write it, including L^AT_EX, I made the book available under a free license, the GNU Free Documentation License.¹

Authors today do this more often but back then giving away a book was unusual. Since this material has been around for longer than most, perhaps a discussion of my experience would be helpful to someone considering such a project.

I will discuss advantages and disadvantages of using T_EX for this, and a few other points. I won't list the T_EX code but you can get it from the book's web page: <http://joshua.smcvt.edu/linearalgebra>.

1 Background

The book *Linear Algebra* is for a US undergraduate course often taken during a student's second year. The pedagogical goal is to help these young students make a transition from the formula-driven early classes to proof-driven later courses. It is popular, with 100,000 downloads last year, and it is often listed first in a "linear algebra" web search.

In addition to the PDF of the text, downloaders can get the full L^AT_EX source. They can also get a PDF of the fully-worked answers to all exercises, even the proofs.

All this was helped by using L^AT_EX. For one thing, I wasn't paying a typesetter so I didn't have to recoup that cost, and revisions cost me no money. I also benefited from the advanced and free tools, such as GNU/Linux and Emacs with AUCT_EX, that fit a L^AT_EX workflow.

2 L^AT_EX helps

I put *Linear Algebra* up for download more than a decade ago. What I offer now is essentially unchanged from what I offered then. That is, because I use L^AT_EX, I have had no bit rot: I've never had emails that say, "I have version 5 of the program and you've used version 6 and I'm having trouble." This is great because an author providing material at no profit has nothing to gain from version maintenance.

With time, I have enjoyed a number of other advantages of T_EX-based production. The main one is that because T_EX produces first-class output, an instructor can without apology use the material in class. Another advantage is that the source is compact, limiting the amount by which downloads impact my college's bandwidth.

¹ <http://www.gnu.org/licenses/fdl.html>

3 Doing the exercises

When I started, I knew very little L^AT_EX. Back then there were fewer packages and I had to program many of my needs myself. I'll try to give a potential author a sense of the process by discussing what happened in just one area, producing the exercises.

First, I wanted to number the formal parts in a single sequence, including the exercises. Thus, if a section ends with a lemma and a theorem numbered 1.15 and 1.16 then the problems should start with 1.17. For this, I had to read some L^AT_EX source and even small adjustments of existing macros can take some head-scratching. Looking back, I'd guess this beginner's step took a day to work out.

Next I wanted to mark some exercises for people reading the text on their own. I needed that

```
\begin{exercises}
\recommended\item Calculate the ..
```

would put a check in the margin next to the exercise. This used L^AT_EX lists and I had to ask online about a point — perhaps it cost me two days.

My third problem was harder. I wanted the source file to include answers to the exercises.

```
\begin{exercises}
\item Prove that ..
\answer{Observe first that ..}
```

For this, T_EX writes the answer text to a separate file, including in that file the exercise number. I could not have done the programming but fortunately Mike Piff provided the `answers` package to do exactly this.

(Many texts have either limited answer sets or else the answers are not written by the author. If you are a potential author, I urge you to consider doing full answers. While providing these answers, and L^AT_EX-ing them myself, was a great deal of trouble, it made the book much better for learners. For example, answering an exercise might bring out a subtlety and so I'd go back to adjust one of the examples.)

However, for my exercises I had to do more than Mike's package provided. I wanted a hyperlink from each question to its answer and one from the answer to the question. For this I had to code inside the `hyperref` package, which is hard. Perhaps this cost me three days.

Another problem with the exercises arose after I put the book up for download. Instructors wanted to assign hand-in problems but didn't want to invent their own. The fact that students could download all the answers prevented these instructors from using the book. In response I tried posting only some answers, which required that I develop an option to produce only the answers to recommended exercises.

\TeX 's `if` constructs gave me trouble, so this cost me a couple of days. (At that time my policy was that to get all the answers a person had to email me with a good story. After a while the absurdity of this became compelling and besides, finding the entire set of answers by searching online became easy, so I am now back to offering all the answers.)

I never solved my final problem. My workflow was to compile the document, generating the answers as a separate file, and then to compile those answers. If \LaTeX found errors in the answers then it reported line numbers from the generated file. But I needed the line number from the original source file. I hacked at this a bit, but eventually felt that I should be writing the book instead of writing the tool used for the book, and so I never got it to go.

4 Positives, negatives

Providing the book free for download has had some positive effects. I am delighted to get emails from people, particularly people with few resources, who say that they have been helped by the text and by its availability. Another positive is the bug reports that some readers send. That is, providing it freely has garnered both exposure and good will.

There have also been some aspects of this distributing method that were more mixed.

I know of five projects to use the source as the basis for a translation. But while one project is still in progress and looks promising, the other attempts have petered out.

I also know of three projects to use the source to make a wiki. The one I know the best was very well done and includes all of the text and illustrations. However, these projects never achieved true wiki-osity in that they never became dynamic documents with many contributors.

The experiences of the wiki folks matches my own. I imagined that providing the \LaTeX source would allow instructors to adjust the text by adding or deleting sections or exercises. In particular, each chapter has sections of topics, which are optional, light, extensions of the material. On the download page I solicited contributions of more topics and exercises and seeded my collection by imposing on a few colleagues. To get contributors started, I provided a booklet on compiling the text's source. However my imagination was wrong; no contributions have appeared.

Finally, I will mention a potential negative aspect of free distribution: people have downloaded the

book and put it up for sale at online print-on-demand publishers. Some of these are instructors or schools who want their students to buy the paper book for a course, which is perfectly natural and fine (in fact, after many calls I've put on the download page a note to college bookstores assuring them that it is allowed). In another case the people involved sell the text at cost, to make a paper version easily available. But I also know of people who simply grabbed some freely available books to sell for a profit, which is annoying. Perhaps I will someday put up my own on-demand version but so far I have stuck to online distribution.

5 Possibilities

When I started, there were no stand-alone book display devices so I did not provide the material in a format that suits these. Were I starting this project today, I would study the possibilities of these alternative platforms.

Even more interesting are the possibilities for interactive goodness. Today PDF is an open standard and allows JavaScript, so there is a stable way to get cross-platform interactivity.

The most exciting possibility would be to have a group of people contributing applications. Anyone who watches an active Internet community has to be impressed with the tremendous creativity and energy that can happen when great people get going. Again, the fact that \LaTeX is a standard with first-rate output makes this at least conceivable.

6 Closing

Free distribution, particularly based on \TeX , has some real advantages but some trade-offs as well.

Chief among the advantages of \LaTeX for this project were its high-quality output, its stability, and the widespread availability of associated tools. Because of these advantages, I could offer a text free for download without a long-term commitment to maintenance.

The main disadvantage to producing the work in \LaTeX was the coding. This may be mitigated by the fact that there are more \LaTeX packages today, so the need for individual coding may be reduced.

If you take on such a project, enjoy!

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