

into a two dimensional display. Since \TeX has been available widely for a number of years, it is well understood by a large population, although, as public-domain software it lacks the outright backing of any large commercial organisation.

The approach adopted by \TeX , and the lessons which may be learned from it, can be put to good use as part of the ODA standard for mathematical encoding. It is not the contention here that only \TeX is a suitable vehicle, or even that adoption of \TeX as it exists now is the very best solution. The principal argument is that to exclude it from discussion and examination would be counter-productive and limiting.

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Teaching \TeX

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Acknowledgements, Disclaimer, and Calls

This is a continuation of the paper on "Syllabi for \TeX and METAFONT courses", pages 117-127 in the Proceedings of the 9th TUG meeting. This paper contains some of the details of the previous paper in tabular form. The errors are mine, but many of the ideas are those of the teams who did the work. I would especially like to thank Barbara Beeton, Dean Guenther, Pierre MacKay, and David Ness for their continual reading, editing, and other input. Don Knuth also reviewed an earlier draft and said he is no longer a "10". Well ...

This paper includes a flow chart to illustrate the prerequisites of \TeX , \LaTeX , and METAFONT classes. A two page table is used to show the contents of the \TeX courses, and another table shows the contents of the \LaTeX courses. The \LaTeX overview was not written by \LaTeX experts. The three level test for \TeX has been revised several times.

I am **calling** for input of the following form:

1. constructive criticism of this document, especially the \LaTeX contents;
2. submission of additional questions for the \TeX tests;

3. submission of questions for the (yet to be done) \LaTeX tests; and
4. your suggestions for any other items that you think will help.

I will make these sources available for all. I intend to incorporate input and reissue this document on a periodic basis. The rest of this paper is what I would distribute.

Overview

A user should be familiar with the use of a text editor before undertaking the *Beginning \TeX* course. In some cases the user can employ a word processor and store the file as an ordinary text file if such an editor is the user's common means of creating a file.

The *Beginning \TeX* course should give the student an understanding of the basic nature of \TeX and the parameters it uses in producing attractive documents. After the course, the student will feel comfortable taking examples from *The \TeX book* for use, but may not yet be fully at ease modifying these examples.

Upon completion of the *Intermediate \TeX* course, the student should be able to adapt and modify examples from *The \TeX book* to suit individual purposes. He or she will also be able to develop creative solutions to typesetting problems using \TeX .

The *Advanced \TeX* course should give the student knowledge of how many of the examples in *The \TeX book* are created. Further, the student should be able to create new macros and documents using these concepts. At this stage of knowledge, \TeX 's capability as a 'text-oriented programming language' can be exploited.

Beginning \TeX

This course provides a practical introduction for those with limited, or no, exposure to \TeX and will be composed of about equal parts lecture and "hands-on" sessions, including many practical exercises for each object of study. Participants will be introduced to \TeX as a language for typesetting, also learning its context in the history and milieu of word-processing and typesetting. \TeX is compared with other popular formatting systems such as word-processors and desktop publishing systems.

\TeX concepts to be covered include: methods of preparing simple paragraphs, changing line spacing and specifying fonts; simple boxes, characters and accents; justification and line breaking. In math mode, superscripts, subscripts, and fractions will be addressed.

Each registrant will be given copies of *The T_EXbook* and *First Grade T_EX*.

Prerequisite: familiarity with a text editor is essential.

Intermediate T_EX

This course comprises equal parts lecture and laboratory sessions, including many practical exercises. It builds upon the foundation laid at the beginning level.

Topics to be covered include: more complicated paragraph shapes, paragraphs with labels, hanging indentation; more complex interaction between glues and boxes; greek letters, special symbols and delimiters in math mode; displayed equations; control of line and page breaks; simple tables.

Prerequisite: Beginning T_EX or equivalent knowledge.

The student will furnish his/her own copy of *The T_EXbook*.

Intensive T_EX

This course is a combination of the above two courses. It is taught at a high speed in approximately one week.

Advanced T_EX

This course is designed for *all* experienced T_EX users and includes both lectures and experimentation. This course will give an intensive study of macro writing and designing macro packages.

Topics will include: detailed explanation of the relationship of boxes (`\vbox`, `\vtop` and `\hbox`) and glue; usage of registers, especially box registers and counter registers; basic concepts and ideas of macros; use of `\halign` in constructing tables and equation arrays in math mode; loading fonts, magnification, kerning, ligatures; controlling the line and page breaking algorithms; delimited and undelimited macro parameters; global *vs.* local definitions; conditionals, loops, and counters; tools such as `\let`, `\futurelet`, `\chardef`, `\catcode`, and `\begingroup`; expansion of tokens, and when such expansion takes place. We will design macros in class and analyze common constructions, with practice in interpreting existing macros so that they may be customized for special applications.

Prerequisite: Intermediate T_EX or equivalent knowledge.

Course Contents

Following the tests below are tables showing several topics concerned with T_EX and typesetting. The tables attempt to indicate the suggested detail in

which these topics are covered in each of the three courses.

The T_EX Test

The test is divided into three levels. The first level is intended for students who have completed the **Beginning T_EX** course. Upon completion of the course, you should be able to answer at least 75% of the questions with correct answers. We would hope that it could be done without reference to the *T_EXbook*, *First Grade T_EX*, or other sources. With these sources and an extra thirty minutes or so you should be able to answer all the questions, regardless of your instructor.

Performance at this level on the first test should be a prerequisite for taking the **Intermediate T_EX** course. Similarly, an equivalent level of performance on the second test should be a prerequisite for the **Advanced T_EX** course. Completion of the third course should lead to a good score on the third level of the test.

We realize that a lot of T_EXers have been self taught. We feel the tests could be used as effective self-tests after independent study of the *The T_EXbook* or another such manual.

Many of the questions contain fragments of T_EX code. These fragments are in the typewriter font and their lines are numbered. Ellipses (...) are used liberally to indicate that more T_EX material may be present.

These tests and other teaching materials are the property of the T_EX Users Group. They may be used freely for the purpose of expanding knowledge about T_EX systems as long as proper credit to their source and acknowledgment of the goals and purpose of the T_EX Users Group are prominently displayed.

The T_EX Users Group solicits contributions and opinions on these materials. We intend to reissue these materials on a regular basis with updates containing new contributions.

The tests are based on levels of expertise varying from 0 to 10. Level 0 corresponds to knowing nothing about T_EX while Donald Knuth is level 10.

The T_EXtest — Level One

1. One of the visible ASCII characters is used as T_EX's escape character. It is the ____ symbol and its name is _____.
2. In the following T_EX code fragment:

1 ...

- 2 last line of a paragraph.
 3 `\parskip=6pt`
 4 First line of a new paragraph
 what horizontal and vertical spaces will be between "... a paragraph." and "First line...?"
3. What TeX control sequence is the equivalent of a blank line?
 4. How do you cause the TeX program to execute and process the file "testfile.tex" on your system?
 5. When TeX has finished processing "testfile.tex", how can you get another look at the error messages (with more detail) without running TeX again?
 6. The code fragment "the \TeX program" produces output "the TeXprogram" which is obviously missing a space after the TeX logo. Give two or more ways to correct this.
 7. What is the name of TeX's monospaced font and what control sequence is used to access it?
 8. What is the typographer's name for straight lines?
 9. How do you end the indentation from the `\narrower` instruction?
 10. How should you end the current paragraph before ending the `\narrower` mode?
 11. What is the indentation of the following paragraph and why?


```
1  {\narrower\narrower
2  first line of a paragraph.
3  ...
4  last line of a paragraph.
5  }\par
```
 12. Consider the following code fragment:


```
1  \parindent=0.5in
2
3  A first paragraph ...
4  \parindent1.0in
5
6  A second paragraph ...
7  \bye
```

How much will each of the paragraphs be indented? first _____ second _____
 13. How do you specify an italic correction?
 14. What does an italic correction do?
 15. Is the space in:


```
1
2  \centerline {Centered}
3
```

necessary _____, optional _____, or in error _____?

16. What will TeX output from the following code fragment?


```
1
2  \centerline Center This!
3
```
17. Describe the output of this code fragment?


```
1  \bf{this is bold text} ...
```
18. What is a widow?
19. How do you place the page number flush right in a running head?
20. How do you keep the left margin fixed and move the right margin to the left by 0.5in?

A new TeX user has decided to create some macros. The following definitions are OK or BAD! Mark each of these OK or BAD, and indicate what is wrong with the BAD ones. Assume the plainest of TeXs.

21. `\def\A1{...}`
22. `\def\A-OK{...}`
23. `\def\Test{...}`
24. `\def\{\...}`
25. `\def\10{...}`

There are ten visible ASCII characters that TeX has reserved for special uses. For example, the dollar sign is used to toggle mathematics mode. List the other nine and their use as illustrated.

26. \$ toggle math mode
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____

The TeXtest — Level Two

1. What *mode* is TeX in when building a paragraph?
2. How do you end a `\topinsert`?
3. If TeX hyphenates a word badly, how do you fix it?
4. What happens to a paragraph that has both normal indentation and a `\hangindent` specification?
5. What will `\line{A Short Line}` look like in a normal page?

6. Why won't a field like `{\hfil x \hfil}` be centered in a `\settabs` environment?
7. How can you get a black square, like , in the middle of a line of text?
8. Consider the code fragment:


```
1  ...
2  \eject\vskip2in
3  How now brown cow...
```

 Where is the "How now brown cow" placed relative to the top margin of the page?
9. How do you move a `\vbox` to the right one inch?
10. How do you reduce or prevent widows?
11. What is a penalty?
12. What happens when you forget to end a `\footnote`?
13. What happens when you try to end a document without a proper end to an insert?
14. What happens if you have a blank line in display math mode?
15. How is the `\tabskip` parameter used?
16. How are the `\lineskip` and `\lineskiplimit` parameters used?
17. What actions should you consider to correct the conditions that caused the warning `Overfull hbox?`
18. What actions should you consider to correct the conditions that caused the warning:


```
1  Underfull \vbox has occurred
2  while \output is active
```
19. Show how to assign the control sequence `\8` to a new font "cmss8" that has not already been defined in plain `TeX`.
20. What is the meaning of `#1` in a macro definition?
21. Arguments to macros may be *delimited* or *undelimited*. Describe how `TeX` determines arguments in the two cases. How do users notice the difference?
5. Are the leading spaces in `\halign` entries significant?
6. Are the trailing spaces in `\halign` entries significant?
7. Are the leading and trailing spaces in `\settabs` entries significant?
8. How serious will underfull `vbox` badness 3412 be?
9. Build a macro called `\xx` that has one parameter delimited by a semicolon. The macro is to center its one parameter and set it in bold.
10. What happens when `\def\p#1{\it\centerline#1}` is called with `\p01234`?
11. The following code fragment is an exercise in being careful:


```
1  \newcount\cntr
2  \advance\cntr1\the\cntr1
```

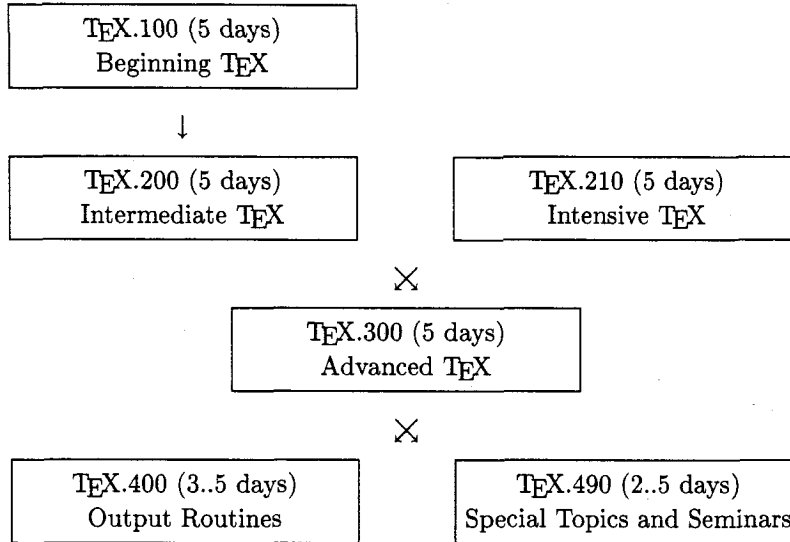
 What is the resulting value of the counter?
12. How can you zero all the dimensions of `box0`?
13. What information is in a `tfm` file?
14. What information is stored in a `pk` or `gf` file?
15. How are `\vtop` and `\vbox` similar? How do they differ?
16. A two column macro package works by gathering enough information for both columns before invoking the `\output` routine. What is the name of the `TeX` primitive that is probably used to determine each column?
17. What does `\futurelet` allow you to do?
18. What `TeX` commands would you have to use to automatically build an index and/or table of contents to a separate file, and print it in the output?
19. What happens when you underestimate the number of lines in a `\parshape` command?
20. Under what conditions can you use the built-in fonts of an arbitrary printer?
21. What characteristics should you look for on a page of output to try to determine if the page was prepared using *PageMaker*, *troff*, ..., or `TeX`.
22. What element(s) of `TeX` is (are) case insensitive?

The `TeX`test — Level Three

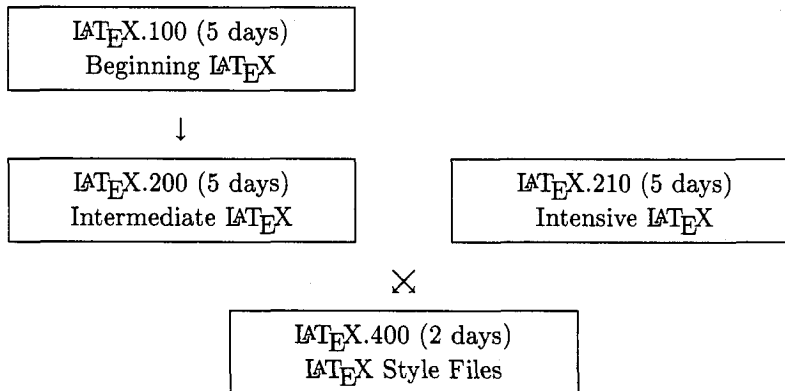
1. How is `TeX`'s escape character determined?
2. What is the name of the control sequence that can be used to accomplish the function of the left brace, `{`, inside a macro that will not have its matching right brace, `}`?
3. What are the names of the parameters that specify the amount of glue above and below display math?
4. `TeX` treats several consecutive spaces as one. Thus the usual practice of keyboarding 2

TITLES and PREREQUISITE STRUCTURE

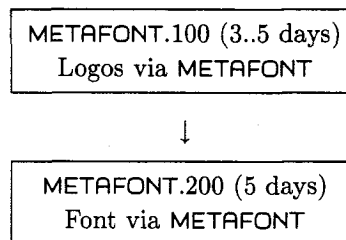
TEX Courses



L^AT_EX Courses



METAFONT Courses



T_EX Courses — Contents

| Beginning | Intermediate | Advanced |
|--|--|---|
| Typesetting | | |
| Typesetting Milieu, Design and Typesetting Dimensions, T _E X and WYSIWYG | What you should unlearn (Underlines, ...), Magnification | |
| Design | | |
| margins, typesize, \leftskip, \rightskip, \narrower, \parindent | penalties and affecting design, \looseness, \tolerance | Database driven design, interface between T _E X and other worlds, \pagegoal, \prevgraf |
| Programming | | |
| Public domain, why pay, WEB Use of ASCII keyboard How it runs | It is a programming language | WEB and internal structure |
| T_EX and Other Things | | |
| T _E X vs. L ^A T _E X vs. Script vs. vs. Pagemaker vs. WORD ... | What can and cannot be imported and exported | |
| Markup Language | | |
| They exist, What is plain Primitives vs. Macros | plain.tex as info source, A _M S-T _E X, L ^A T _E X what - why? | Designing your own |
| Syntax | | |
| {}, do they surround or follow | Spaces that behave unexpectedly | Why \obeylines works like it does, \obeyspaces, verbatims |
| Spacing | | |
| Significant / Insignificant Spaces Tilde, Slash, Space \hskip, \vskip, \baselineskip | \vglue, \kern, \hbox, \vbox, \vspace, \vglue, \hspace, \thinspace | letterspacing, sidebarring |
| Glue | | |
| Dimensions, Terminology | Stretchability / Shrinkability Negative glues | Output Routines \splittopskip, \splitmagstep, \vsplit, \vadjust, \unhbox, \unvbox |
| Boxes | | |
| Primarily in Error Messages Boxes have height, depth, and width | moving boxes around \raise, \lower, \moveright, ... What \hbox \vbox are Stephan's \hboxr \vboxr | Understanding Stephan's boxing |
| Rules | | |
| \hrule | \hrules and \vrules <i>au naturel</i> \?rules for \struts \?rules for boxes | |
| Fonts | | |
| What is a font, CM family What does T _E X needs to know Other fonts ? | What are sources of fonts Scaling and metrics pk vs. p _l vs. gf Proprietary fonts, their limits | Introduce METAFONT TFxxxxx PKxxxxx etc. |
| Paragraphs | | |
| Paragraphs, especially \parindent, \parskip, \par | \narrower, \hangindents, \items | \parshape, \prevgraf |
| Lines | | |
| \centerline, \leftline ... \line | line / paragraph interactions + meaning | everyline? |
| Math | | |
| Display math as paragraph suspender In-line math | Subscript Superscript (incl use as footnote numbers) \eqalign and other math stuff | Broken equations Special math spacing Special math fonts |

T_EX Courses — Contents

| Beginning | Intermediate | Advanced |
|---|---|---|
| Macros | | |
| Macros as shorthand | Macro with parameters, delimiters | <code>\unskip</code> , <code>\outer</code> , <code>\xdef</code> , <code>\gdef</code> Combinations of macros Macro structure and exceptions |
| Debugging | | |
| Simple debugging Putting in artificial ends ... | Purposeful errors <code>\showthe</code> , <code>\showbox</code> , <code>\show</code> | <code>\tracing...</code> and <code>\showbox</code> Visible boxes, <code>\tracingall</code> |
| Errors | | |
| Flesh wounds, Fatal errors, Misunderstandings Which can be ignored ? | When errors can be understood | Genuine obscurities |
| Tabs and Alignment | | |
| <code>\settabs</code> , <code>\tabalign</code> , <code>\cr</code> Copy alignment from T _E Xbook and Use it | Copy an alignment and modify it <code>\hidewidth</code> , <code>\omit</code> , <code>\strut</code> , <code>rules</code> | Create an alignment Alignments and Rules |
| Penalties | | |
| Notice that they exist <code>\hyphenpenalty</code> | Penalties in formatting <code>\goodbreak</code> ... | All penalties — What they really do |
| Output Routines | | |
| No mention except for <code>\hoffset</code> , <code>\voffset</code> , <code>\footnotes</code> | <code>\footnotes</code> with numbers | [We had nothing?] |
| I/O Management and Files | | |
| Comments, Documentation etc. | <code>\input %</code> to get rid of spaces | writes index table of contents |
| Modes | | |
| No mention other than <code>\\$</code> confusion | <code>\hmode</code> <i>vs.</i> <code>\vmode</code> what and how Math modes, Restricted modes | <code>\ifvmode</code> ... |
| Inserts | | |
| <code>\topinsert</code> | <code>\midinsert</code> , <code>\pageinsert</code> , insert interaction | |
| Chars | | |
| No Mention | <code>\def\xx{\char..}</code> | Redefine Chars |
| Graphics and T_EX | | |
| | Space for graphics, <code>\boxit</code> | PiCT _E X other things available, Manual, L ^A T _E X Circle and Line Fonts, Rounded Boxes |
| Tokens | | |
| No mention | No mention | Explain tokens |
| Font Families | | |
| No mention | Mention | Understand and create |
| Control Structures | | |
| Grouping simple existing <code>\ifs</code> | <code>\begingroup</code> , <code>\endgroup</code> , <code>\ifs</code> modifying existing <code>\ifs</code> , create <code>\newcount</code> , <code>\newdimen</code> | <code>\new...</code> , <code>\bgroup</code> , <code>\egroup</code> , <code>\repeat</code> , creation of <code>\ifs</code> <code>\futurelet</code> , <code>\expandafter</code> , <code>\afterassignment</code> , <code>\noexpand</code> |
| PotPourri—Anomalies, Etc. | | |
| | | T _E X and SGML dvi and PostScript Graphics, availability, ... |

L^AT_EX Courses — Contents

| Beginning | Intermediate |
|--|---|
| Typesetting | |
| L ^A T _E X, Typesetting milieu, Design, Dimensions | What you should unlearn (underlines, ...) |
| Design | |
| margins, typesize, \leftskip, \rightskip, \narrower, \parindent | Penalties affecting design, \looseness, \tolerance |
| L^AT_EX and Other Things | |
| L ^A T _E X vs. Script vs. L ^A T _E X vs. Pagemaker vs. WORD ... Public domain, written in T _E X, Use of ASCII keyboard, How it runs | What can and cannot be imported and exported A ^M S-T _E X, L ^A T _E X – what do they do, and compare to a markup language |
| Syntax | |
| {}, []'s, and \begin - \end | Spaces that behave unexpectedly |
| Spacing | |
| Significant/Insignificant spaces, Tilde, Slash, Space, \hspace, \vspace, \hfil | *'d as opposed to not |
| Glue | |
| Dimensions, Terminology | Stretchability/Shrinkability, Negative glues |
| Boxes | |
| Only in error messages | \mbox, \makebox, \fbox, \framebox |
| Rules | |
| \rule | |
| Fonts | |
| What is a font, CM family, What does L ^A T _E X need to know, Governed by logical structure | \newfont is rare, math fonts are different |
| Paragraph Environments | |
| Quotations, centering, verbatim, verse | \narrower, \hangindents, \items |
| Line Environments | |
| flushright, flushleft, \raggedright | Line/paragraph interactions & meaning |
| List Environments | |
| Itemize, enumerate, description | [More] |
| Math Environments | |
| In-line and display | [Much more] |
| Environments in general | |
| | \picture and more on the others |
| Styles | |
| Discuss article, book, letter, report, etc. | |
| Definitions | |
| Commands (macros) as shorthand | \newcommand, \newenvironment, \renewcommand |
| Debugging | |
| Simple debugging, putting in artificial ends ... | Purposeful errors, \showthe, \showbox, \show |
| Errors | |
| Flesh wounds, Fatal errors, Misunderstandings, When not to worry about content | Special L ^A T _E X errors |
| Tables | |
| Arrays and tabular alignment | |
| Penalties | |
| Notice that they exist, Errors fall through to T _E X | Penalties in formatting |
| I/O Management and Files | |
| Comments, Documentation, etc. | \includes |
| Inserts | |
| Some objects (tables and figures) float | |
| PotPourri—Anomalies, Etc. | |
| What is L ^A T _E X's meaning of objects? | |