

The UK T_EX FAQ

Your 244 Questions Answered

version 3.0b, date 2002/05/21

Maintained by Robin Fairbairns

May 29, 2002

NOTE

This document is an updated and extended version of the FAQ article that was published as the December 1994 and 1995, and March 1999 editions of the UK TUG magazine *Baskerville* (which weren't formatted like this). The article is also available via the World Wide Web.

Contents

A Introduction	3	D Bits and pieces of T_EX	12
B The Background	4	33 What is a DVI file?	12
1 What is T _E X?	4	34 What is a driver?	12
2 How should I pronounce "T _E X"?	4	35 What are PK files?	13
3 What is METAFONT?	4	36 What are TFM files?	13
4 What is MetaPost?	4	37 Virtual fonts	13
5 How can I be sure it's really T _E X?	5	38 \special commands	13
6 Are T _E X and friends Y2K compliant?	5	39 Documented L ^A T _E X sources (.dtx files)	13
7 What is L ^A T _E X?	5	40 What are encodings?	13
8 What is L ^A T _E X 2 _ε ?	5	41 How does hyphenation work in T _E X?	14
9 How should I pronounce "L ^A T _E X(2 _ε)"?	5	42 What are the EC fonts?	14
10 Should I use Plain T _E X or L ^A T _E X?	5	43 What is the TDS?	15
11 How does L ^A T _E X relate to Plain T _E X?	6	44 What is "Encapsulated PostScript"	15
12 What is ConT _E Xt?	6	E Acquiring the Software	15
13 What are the AMS packages (<i>A_MS-T_EX</i> , etc.)?	6	45 Repositories of T _E X material	15
14 What is Eplain?	6	46 What's the CTAN <i>nonfree</i> tree?	16
15 What is Lollipop?	6	47 Contributing a file to the archives	16
16 What is Texinfo?	7	48 Finding (L ^A)T _E X macro packages	16
17 If T _E X is so good, how come it's free?	7	49 Finding files in the CTAN archives	16
18 What is the future of T _E X?	7	50 Finding files by Web search	17
19 Reading (L ^A)T _E X files	7	51 Finding new fonts	17
20 Why is T _E X not a WYSIWYG system?	7	52 T _E X CD-ROMs	17
21 T _E X User Groups	8	F T_EX Systems	17
C Documentation and Help	8	53 (L ^A)T _E X for different machines	17
22 Books on T _E X and its relations	8	54 T _E X-friendly editors and shells	19
23 Books on Type	9	55 Commercial T _E X implementations	19
24 Where to find FAQs	10	G DVI Drivers and Previewers	20
25 Where to get help	10	56 DVI to PostScript conversion programs	20
26 How to ask a question	10	57 DVI drivers for HP LaserJet	21
27 (L ^A)T _E X Tutorials, etc.	11	58 Output to "other" printers	21
28 Learning to write L ^A T _E X classes and packages	11	59 DVI previewers	21
29 METAFONT and MetaPost Tutorials	11	H Support Packages for T_EX	21
30 B _I B _T _E X Documentation	12	60 Fig, a T _E X-friendly drawing package	21
31 Where can I find the symbol for...	12	61 T _E XCAD, a drawing package for L ^A T _E X	21
32 The P _I C _T _E X manual	12	62 Spelling checkers for work with T _E X	21
		63 How many words have you written?	22
		I Literate programming	22
		64 What is Literate Programming?	22
		65 WEB systems for various languages	22

J	Format conversions	22	P.2	Document structure	39
66	Conversion between (L ^A)T _E X and others	22	110	The style of document titles	39
67	Conversion from (L ^A)T _E X to plain ASCII	23	111	The style of section headings	39
68	Conversion from SGML or HTML to T _E X	23	112	Indent after section headings	40
69	(L ^A)T _E X conversion to HTML	24	113	How to create a \subsubsection	40
70	Using T _E X to read SGML or XML directly	24	114	The style of captions	40
71	Retrieving (L ^A)T _E X from DVI, etc.	25	115	Alternative head- and footlines in L ^A T _E X	40
72	Translating L ^A T _E X to Plain T _E X	25	116	Changing the margins in L ^A T _E X	40
K	Hypertext and PDF	25	117	Wide figures in two-column documents	41
73	Making hypertext documents from T _E X	25	118	1-column abstract in 2-column document	41
74	Making Acrobat documents from L ^A T _E X	25	119	Really blank pages between chapters	42
75	Quality of PDF from PostScript	26	120	Balancing columns at the end of a document	42
76	Finding ‘8-bit’ Type 1 fonts	26	P.3	Page layout	43
77	Replacing Type 3 fonts in PostScript	27	121	How to get rid of page numbers	43
L	METAFONT and MetaPost	27	122	\pagestyle{empty} on first page in L ^A T _E X	43
78	Getting METAFONT to do what you want	27	123	How to create crop marks	43
79	Which font files should be kept	28	124	‘Watermarks’ on every page	43
80	Acquiring bitmap fonts	28	125	Typesetting things in landscape orientation	43
81	Making MetaPost output display in <i>ghostscript</i>	28	126	Putting things at fixed positions on the page	44
M	PostScript and T_EX	29	P.4	Spacing of characters and lines	44
82	Using PostScript fonts with T _E X	29	127	Double-spaced documents in L ^A T _E X	44
83	Previewing files using Type 1 fonts	29	128	Changing the space between letters	44
84	T _E X font metric files for PostScript fonts	30	129	Setting text ragged right	44
85	Deploying Type 1 fonts	30	130	Cancelling \ragged commands	45
86	Choice of scalable outline fonts	30	P.5	Typesetting specialities	45
87	Including a PostScript figure in (L ^A)T _E X	33	131	Including a file in verbatim in L ^A T _E X	45
88	Weird characters in <i>dvips</i> output	34	132	Including line numbers in typeset output	45
N	Bibliographies and citations	34	133	Generating an index in (L ^A)T _E X	45
89	Creating a bibliography style	34	134	Typesetting URLs	46
90	Capitalisation in BIBT _E X	34	135	Typesetting music in T _E X	46
91	‘String too long’ in BIBT _E X	34	136	Other “document font” sizes?	46
92	BIBT _E X doesn’t understand my lists of names	34	137	Zero paragraph indent	47
93	Citing URLs with BIBT _E X	35	138	Set specifications and Dirac brackets	47
94	Using BIBT _E X with Plain T _E X	35	139	Big letters at the start of a paragraph	47
95	Separate bibliographies per chapter?	35	140	Code listings in L ^A T _E X	47
96	Multiple bibliographies?	35	141	The comma as a decimal separator	48
97	Putting bibliography entries in text	36	142	Breaking boxes of text	48
98	Sorting and compressing citations	36	P.6	Tables of contents and indexes	48
99	Multiple citations	36	143	The format of the Table of Contents, etc.	48
100	Listing all my BIBT _E X entries	36	144	Unnumbered sections in the Table of Contents	48
101	Making HTML of your Bibliography	37	145	Bibliography, index, etc., in TOC	49
O	Installing (L^A)T_EX files	37	146	Multiple indexes	49
102	Installing a new package	37	Q	How do I do X in (L^A)T_EX	49
103	Where to put new files	37	Q.1	Mathematics	49
104	“Temporary” installation of (L ^A)T _E X files	38	147	Proof environment	49
P	Adjusting the typesetting	38	148	Roman theorems	49
P.1	Alternative document classes	38	149	Defining a new log-like function in L ^A T _E X	49
105	Formatting a thesis in L ^A T _E X	38	Q.2	Lists	50
106	Setting papers for journals	38	150	Fancy enumeration lists	50
107	A ‘report’ from lots of ‘article’s	38	151	How to reduce list spacing	50
108	<i>Curriculum Vitae</i> (Resumé)	39	Q.3	Tables, figures and diagrams	50
109	Letters and the like	39	152	Fixed-width tables	50
			153	Spacing lines in tables	50
			154	Tables longer than a single page	51
			155	How to alter the alignment of tabular cells	51
			156	Flowing text around figures in L ^A T _E X	52
			157	Drawing with T _E X	52
			158	Drawing Feynman diagrams in L ^A T _E X	52
			159	Floats on their own on float pages	53

Q.4 Footnotes	53	T.2 Making things stay where you want them	68
160 Footnotes in tables	53	204 Moving tables and figures in L ^A T _E X . . .	68
161 Footnotes in L ^A T _E X section headings . . .	53	205 Underlined text won't break	68
162 Footnotes in captions	54	206 Controlling widows and orphans	69
163 Footnotes whose texts are identical . . .	54	T.3 Things have “gone away”	69
Q.5 Document management	54	207 Old L ^A T _E X font references such as <code>\tenrm</code>	69
164 What's the name of this file	54	208 Missing symbol commands	69
165 All the files used by this document . . .	55	209 Where are the <code>msx</code> and <code>msy</code> fonts?	69
166 Marking changed parts of your document	55	210 Where are the <code>am</code> fonts?	69
167 Conditional compilation	55	U Why does it <i>do</i> that?	70
168 Bits of document from other directories .	56	U.1 Common errors	70
169 Version control using RCS or CVS	56	211 L ^A T _E X gets cross-references wrong	70
Q.6 Hyphenation	56	212 Start of line goes awry	70
170 My words aren't being hyphenated . . .	56	213 Why doesn't <code>\verb</code> work within...? . . .	70
171 Weird hyphenation of words	57	214 No line here to end	71
172 (Merely) peculiar hyphenation	57	U.2 Common misunderstandings	71
173 Accented words aren't hyphenated . . .	57	215 What's going on in my <code>\include</code> com-	
174 Using a new language with Babel	57	mands?	71
175 Stopping all hyphenation	58	216 Why does it ignore paragraph parameters?	72
Q.7 Odds and ends	59	217 Case-changing oddities	72
176 Typesetting all those T _E X-related logos .	59	218 Why does L ^A T _E X split footnotes across	
177 Referring to things by their name	59	pages?	72
178 How to do bold-tt or bold-sc	59	219 Getting <code>\marginpar</code> on the right side . .	73
R Symbols, etc.	59	220 Where have my characters gone?	73
179 Symbols for the number sets	59	221 “Rerun” messages won't go away	73
180 Better script fonts for maths	60	222 Commands gobble following space	73
181 Setting bold Greek letters in L ^A T _E X . . .	60	223 (L ^A)T _E X makes overfull lines	74
182 The Principal Value Integral symbol . .	61	V The joy of T_EX errors	75
183 How to use the underscore character . .	61	224 How to approach errors	75
184 How to type an ‘@’ sign?	61	225 The structure of T _E X error messages . .	75
185 Typesetting the Euro sign	61	226 An extra ‘}’??	76
S Macro programming	62	227 Capacity exceeded [semantic nest...] . .	76
186 Finding the width of a letter, word, or		228 No room for a new ‘ <i>thing</i> ’	76
phrase	62	229 <code>epsf</code> gives up after a bit	76
187 How to change L ^A T _E X's “fixed names” . .	62	230 Improper <code>\hyphenation</code> will be flushed .	77
188 Changing the words <i>babel</i> uses	62	231 “Too many unprocessed floats”	77
189 Running equation, figure and table num-		232 <code>\spacefactor</code> complaints	77
bering	63	233 <code>\end</code> occurred inside a group	77
190 Patching existing commands	63	234 “Missing number, treated as zero”	78
191 <code>\@</code> and <code>@</code> in macro names	63	W Current T_EX Projects	78
192 What's the reason for ‘protection’? . . .	64	235 The L ^A T _E X3 project	78
193 <code>\edef</code> does not work with <code>\protect</code> . . .	64	236 The Omega project	78
194 Optional arguments like <code>\section</code>	64	237 The \mathcal{TS} project	78
195 Making labels from a counter	64	238 The PDF _T _E X project	79
196 Finding if you're on an odd or an even page	64	239 Future WEB technologies and (L ^A)T _E X . .	79
197 How to change the format of labels . . .	65	240 The T _E Xtrace project	79
198 Comparing the “job name”	65	X You're still stuck?	80
199 Is the argument a number?	65	241 You don't understand the answer	80
200 Defining macros within macros	66	242 Submitting new material for the FAQ . .	80
201 Spaces in macros	66	243 Reporting a L ^A T _E X bug	80
T Things are Going Wrong...	67	244 What to do if you find a bug	80
T.1 Getting things to fit	67		
202 Enlarging T _E X	67		
203 Why can't I load P _J CT _E X?	67		

A Introduction

This FAQ was prepared by the Committee of the UK T_EX Users' Group (UK TUG) as a development of a regular posting to the *Usenet* newsgroup `comp.text.tex` that was maintained for some time by Bobby Bodenheimer.

The first UK version was much re-arranged and corrected from the original, and little of Bodenheimer's work now remains.

An HTML translation of the FAQ is available on the World-Wide Web, via URL <http://www.tex.ac.uk/faq>; an alternative HTML version is also to be found on the

T_EX Live CD-ROM (see question 52).

Most members of the committee of UK TUG, over the years since 1994, have contributed to this FAQ to some extent. The following people, who have never been members of the committee, have also contributed help or advice: Donald Arseneau, Barbara Beeton, Karl Berry, Giuseppe Bilotta, Damian Cugley, Michael Dewey, Michael Downes, Thomas Esser, Anthony Goreham, Norman Gray, Eitan Gurari, John Hobby, Berthold Horn, Ian Hutchinson, Werner Icking, David Kastrup, Daniel Luecking, Sanjoy Mahajan, Andreas Matthias, Ted Nieland, Pat Rau, Heiko Oberdiek, Piet van Oostrom, Scott Pakin, Oren Patashnik, José Carlos Santos, Walter Schmidt, Joachim Schrod, Ulrik Vieth, Mike Vulis, Peter Wilson, Rick Zaccone and Reinhard Zierke.

Finding the Files

Unless otherwise specified, all files mentioned in this FAQ are available from a CTAN archive, or from one of their mirrors. Question 45 gives details of the CTAN archives, and how to retrieve files from them. If you don't have access to the Internet, question 52 tells you of sources of CD-ROMs that offer snapshots of the archives.

The reader should also note that the first directory name of the path name of every file on CTAN has been elided from what follows, for the simple reason that it's always the same (`tex-archive/`).

To avoid confusion, we've also elided the full stop¹ from the end of any sentence whose last item is a path name (note that such sentences only occur at the end of paragraphs). Though the path names are set in a different font from running text, it's not easy to distinguish the font of a single dot!

B The Background

1 What is T_EX?

T_EX is a typesetting system written by Donald E. Knuth (see <http://sunburn.stanford.edu/~knuth/>), who says in the Preface to his book on T_EX (see question 22) that it is “*intended for the creation of beautiful books — and especially for books that contain a lot of mathematics*”.

Knuth is Emeritus Professor of the Art of Computer Programming at Stanford University in California, USA. Knuth developed the first version of T_EX in 1978 to deal with revisions to his series “the Art of Computer Programming”, but the idea proved popular and he produced a second version (in 1982) is the basis of what we use today.

Knuth developed a system of ‘literate programming’ (see question 64) to write T_EX, and he provides the literate (WEB) source of T_EX free of charge, together with tools for processing the `web` source into something that can be compiled and something that can be printed; there's never any mystery about what T_EX does. Furthermore, the WEB system provides mechanisms to port

T_EX to new operating systems and computers; and in order that one may have some confidence in the ports, Knuth supplied a test (see question 5) by means of which one may judge the fidelity of a T_EX system. T_EX and its documents are therefore highly portable.

T_EX is a macro processor, and offers its users a powerful programming capability. For this reason, T_EX on its own is a pretty difficult beast to deal with, so Knuth provided a package of macros for use with T_EX called Plain T_EX; Plain T_EX is effectively the minimum set of macros one can usefully employ with T_EX, together with some demonstration versions of higher-level commands (the latter are better regarded as models than used as-is). When people say they're “programming in T_EX”, they usually mean they're programming in Plain T_EX.

2 How should I pronounce “T_EX”?

The ‘X’ stands for the Greek letter Chi (χ), and is pronounced by English-speakers either a bit like the ‘ch’ in the Scots word ‘loch’ ([x] in the IPA) or like ‘k’. It definitely is not pronounced ‘ks’.

3 What is METAFONT?

METAFONT was written by Knuth as a companion to T_EX; whereas T_EX defines the layout of glyphs on a page, METAFONT defines the shapes of the glyphs and the relations between them. METAFONT details the sizes of glyphs, for T_EX's benefit, and details the rasters used to represent the glyphs, for the benefit of programs that will produce printed output as post processes after a run of T_EX.

METAFONT's language for defining fonts permits the expression of several classes of things: first (of course), the simple geometry of the glyphs; second, the properties of the print engine for which the output is intended; and third, ‘meta’-information which can distinguish different design sizes of the same font, or the difference between two fonts that belong to the same (or related) families.

Knuth (and others) have designed a fair range of fonts using METAFONT, but font design using METAFONT is much more of a minority skill than is T_EX macro-writing. The complete T_EX-user nevertheless needs to be aware of METAFONT, and to be able to run METAFONT to generate personal copies of new fonts.

4 What is MetaPost?

The MetaPost system (by John Hobby) implements a picture-drawing language very much like that of METAFONT except that it outputs Encapsulated PostScript files instead of run-length-encoded bitmaps. MetaPost is a powerful language for producing figures for documents to be printed on PostScript printers, either directly or embedded in (L^A)T_EX documents. It includes facilities for directly integrating T_EX text and mathematics with the graphics. The PostScript output is of such a simple form that MetaPost output files can be directly included in PDF²L^AT_EX² documents (see question 238). (Knuth tells us that he uses nothing else but MetaPost for diagrams in text that he is writing.)

¹‘Full stop’ (British English)==‘period’ (American English)

²PDF^LA^TE_X cannot normally handle PostScript inclusions

Much of MetaPost's source code was copied from METAFONT's sources with Knuth's permission.

5 How can I be sure it's really T_EX?

T_EX (and METAFONT and MetaPost) are written in a 'literate' programming language called Web (see question 64) which is designed to be portable across a wide range of computer systems. How, then, is a new version of T_EX checked?

Of course, any sensible software implementor will have his own suite of tests to check that his software runs: those who port T_EX and its friends to other platforms do indeed perform such tests.

Knuth, however, provides a 'conformance test' for both T_EX (`trip`) and METAFONT (`trap`). He characterises these as 'torture tests': they are designed not to check the obvious things that ordinary typeset documents, or font designs, will exercise, but rather to explore small alleyways off the main path through the code of T_EX. They are, to the casual reader, pretty incomprehensible!

Once an implementation of T_EX has passed its `trip`, or an implementation of METAFONT has passed its `trap`, test it may reasonably be distributed as a working version.

6 Are T_EX and friends Y2K compliant?

Crashing: None of T_EX, METAFONT or MetaPost can themselves crash due to any change whatever in the date of any sort.

Timestamps: As Knuth delivers the sources, a 2-digit year is stored as the creation time for format files and that value is printed in logfiles. These items should not be of general concern, since the only use of the date format file is to produce the log output, and the log file is designed for human readers only. Knuth's distributed source does not designate the code, which generates this 2-digit date, as a valid area where implementations may differ. However, he announced in 1998 that implementors can alter this code without fear of being accused of non-compliance. Nearly all implementations that are being actively maintained had been modified to generate 4-digit years in the format file and the log, by the end of 1998.

The `\year` primitive: Certification of a T_EX implementation (see question 5) does not require that `\year` return a meaningful value (which means that T_EX can, in principle, be implemented on platforms that don't make the value of the clock available to user programs). The *T_EXbook* (see question 22) defines `\year` as "the current year of our Lord", which is the only correct meaning for `\year` for those implementations which can supply a meaningful value, which is to say nearly all of them.

In short, T_EX implementations should provide a value in `\year` giving the 4-digit year Anno Domini, or the value 1776 if the platform does not support a date function.

Note that if the system itself fails to deliver a correct date to T_EX, then `\year` will of course return an incorrect value. T_EX cannot be considered Y2K

compliant, in this sense, on a system that is not itself Y2K compliant.

Macros: T_EX macros can in principle perform calculations on the basis of the value of `\year`. The L^AT_EX suite (see question 7) performs such calculations in a small number of places; the calculations performed in the current (supported) version of L^AT_EX are known to be Y2K compliant.

Other macros and macro packages should be individually checked.

External software: Software such as DVI translators needs to be individually checked.

7 What is L^AT_EX?

L^AT_EX is a T_EX macro package, originally written by Leslie Lamport, that provides a document processing system. L^AT_EX allows markup to describe the structure of a document, so that the user need not think about presentation. By using document classes and add-on packages, the same document can be produced in a variety of different layouts.

Lamport says that L^AT_EX "*represents a balance between functionality and ease of use*". This shows itself as a continual conflict that leads to the need for such things as FAQs: L^AT_EX *can* meet most user requirements, but finding out *how* is often tricky.

8 What is L^AT_EX 2_ε?

Lamport's last version of L^AT_EX (L^AT_EX 2.09, last updated in 1992) was superseded in 1994 by a new version (L^AT_EX 2_ε) written by the L^AT_EX team (see question 235). L^AT_EX 2_ε is now the only readily-available version of L^AT_EX, and draws together several threads of L^AT_EX development from the later days of L^AT_EX 2.09.

L^AT_EX 2_ε has several enhancements over L^AT_EX 2.09, but they were all rather minor, with a view to continuity and stability rather than the "big push" that some had expected from the team. L^AT_EX 2_ε continues to this day to offer a compatibility mode in which most files prepared for use with L^AT_EX 2.09 will run (albeit with somewhat reduced performance). Differences between L^AT_EX 2_ε and L^AT_EX 2.09 are outlined in a series of 'guide' files that are available in every L^AT_EX distribution; the most important of these files is available on the Web as <http://www.tex.ac.uk/tex-archive/macros/latex/doc/html/usrguide/> and outlines the differences as seen by the ordinary writer of documents and of simple macros.

9 How should I pronounce "L^AT_EX(2_ε)"?

Lamport never recommended how one should pronounce L^AT_EX, but a lot of people pronounce it 'Lay T_EX' or perhaps 'Lah T_EX' (with T_EX pronounced as the program itself; see question 2).

The 'epsilon' in 'L^AT_EX 2_ε' is supposed to be suggestive of a small improvement over the old L^AT_EX 2.09. Nevertheless, most people pronounce the name as 'L^AT_EX-two-ee'.

10 Should I use Plain T_EX or L^AT_EX?

There's no straightforward answer to this question. Many people swear by Plain T_EX, and produce highly respectable documents using it (Knuth is an example of

this, of course). But equally, many people are happy to let someone else take the design decisions for them, accepting a small loss of flexibility in exchange for a saving of brain power.

The arguments around this topic can provoke huge amounts of noise and heat, without offering much by way of light; your best bet is to find out what those around you are using, and to go with the crowd. Later on, you can always switch your allegiance; don't bother about it.

If you are preparing a manuscript for a publisher or journal, ask them what markup they want before you develop your own; many big publishers have developed their own \LaTeX styles for journals and books, and insist that authors stick closely to their markup.

11 How does \LaTeX relate to Plain \TeX ?

\LaTeX is a program written in the programming language \TeX . (In the same sense, any \LaTeX document is also a program, which is designed to run 'alongside', or 'inside' \LaTeX , whichever metaphor you prefer.)

Plain \TeX is also a program written in the programming language \TeX .

Both exist because writing your documents in 'raw' \TeX would involve much reinventing of wheels for every document. They both serve as convenient aids to make document writing more pleasant: \LaTeX is a far more extensive aid.

\LaTeX is close to being a superset of Plain \TeX . Many documents designed for Plain \TeX will work with \LaTeX with no more than minor modifications (though some will require substantial work).

Interpretation of any (\LaTeX) program involves some data-driven elements, and \LaTeX has a wider range of such elements than does Plain \TeX . As a result, the mapping from \LaTeX to Plain \TeX is far less clear than that in the other direction.

12 What is \ConTeXt ?

\ConTeXt (see <http://www.ntg.nl/context/>) is a macro package developed by Hans Hagen, originally to serve the needs of the Dutch firm, Pragma. It was designed with the same general-purpose aims as \LaTeX , but (being younger) reflects much more recent thinking about the structure of markup, etc. In particular, \ConTeXt can customise its markup to an author's language (customising modules for Dutch, English and German are provided, at present).

\ConTeXt is well integrated, in all of its structure, with the needs of hypertext markup, and in particular with the facilities offered by $\PDF\TeX$ (see question 238). The default installation employs a version of \TeX built with both the $\PDF\TeX$ and $\varepsilon\text{-}\TeX$ (see question 237) extensions, and makes good use of both.

\ConTeXt doesn't yet have quite such a large developer community as does \LaTeX , but those developers who are active seem to have prodigious energy.

\ConTeXt distribution: `macros/context`

13 What are the AMS packages ($\AMS\text{-}\TeX$, etc.)?

$\AMS\text{-}\TeX$ is a \TeX macro package, originally written by Michael Spivak for the American Mathematical So-

ciety (AMS) during 1983–1985. It is described in "*The Joy of \TeX* " by Michael D. Spivak (second edition, AMS, 1990, ISBN 0-821-82997-1). It is based on Plain \TeX , and provides many features for producing more professional-looking maths formulas with less burden on authors. It pays attention to the finer details of sizing and positioning that mathematical publishers care about. The aspects covered include multi-line displayed equations, equation numbering, ellipsis dots, matrices, double accents, multi-line subscripts, syntax checking (faster processing on initial error-checking \TeX runs), and other things.

As \LaTeX increased in popularity, authors asked to submit papers to the AMS in \LaTeX , and so the AMS developed $\AMS\text{-}\LaTeX$, which is a collection of \LaTeX packages and classes that offer authors most of the functionality of $\AMS\text{-}\TeX$.

$\AMS\text{-}\TeX$ distribution: `macros/amstex`

$\AMS\text{-}\LaTeX$ distribution:

`macros/latex/required/amslatex`

14 What is \Eplain ?

The \Eplain macro package expands on and extends the definitions in Plain \TeX . \Eplain is not intended to provide "generic typesetting capabilities", as do \LaTeX or \TeXinfo (see question 16). Instead, it provides definitions that are intended to be useful regardless of the high-level commands that you use when you actually prepare your manuscript.

For example, \Eplain does not have a command `\section`, which would format section headings in an "appropriate" way, as \LaTeX 's `\section`. The philosophy of \Eplain is that some people will always need or want to go beyond the macro designer's idea of "appropriate". Such canned macros are fine — as long as you are willing to accept the resulting output. If you don't like the results, or if you are trying to match a different format, you are out of luck.

On the other hand, almost everyone would like capabilities such as cross-referencing by labels, so that you don't have to put actual page numbers in the manuscript. Karl Berry, the author of \Eplain , says he is not aware of any generally available macro packages that do not force their typographic style on an author, and yet provide such capabilities.

\Eplain distribution: `macros/eplain`

15 What is \Lollipop ?

\Lollipop is a macro package written by Victor Eijkhout; it was used in the production of his book " *\TeX by Topic*" (see question 27). The manual says of it:

\Lollipop is 'TeX made easy'. \Lollipop is a macro package that functions as a toolbox for writing \TeX macros. It was my intention to make macro writing so easy that implementing a fully new layout in \TeX would become a matter of less than an hour for an average document, and that it would be a task that could be accomplished by someone with only a very basic training in \TeX programming.

Lollipop is an attempt to make structured text formatting available for environments where previously only WYSIWYG packages could be used because adapting the layout is so much more easy with them than with traditional \TeX macro packages.

The manual goes on to talk of ambitions to “capture some of the \LaTeX market share”; it’s a very witty package, but little sign of it taking over from \LaTeX is detectable. . . An article about Lollipop appeared in *TUGboat* **13**(3).

Lollipop distribution: macros/lollipop

16 What is Texinfo?

Texinfo is a documentation system that uses one source file to produce both on-line information and printed output. So instead of writing two different documents, one for the on-line help and the other for a typeset manual, you need write only one document source file. When the work is revised, you need only revise one document. You can read the on-line information, known as an “Info file”, with an Info documentation-reading program. By convention, Texinfo source file names end with a `.texi` or `.texinfo` extension. You can write and format Texinfo files into Info files within GNU *emacs*, and read them using the *emacs* Info reader. You can also format Texinfo files into Info files using *makeinfo* and read them using *info*, so you’re not dependent on *emacs*. The distribution includes a *Perl* script, *texi2html*, that will convert Texinfo sources into HTML.

Texinfo distribution: macros/texinfo/texinfo

17 If \TeX is so good, how come it’s free?

It’s free because Knuth chose to make it so. He is nevertheless apparently happy that others should earn money by selling \TeX -based services and products. While several valuable \TeX -related tools and packages are offered subject to restrictions imposed by the GNU General Public Licence (‘Copyleft’), \TeX itself is not subject to Copyleft.

There are commercial versions of \TeX available; for some users, it’s reassuring to have paid support. What is more, some of the commercial implementations have features that are not available in free versions. (The reverse is also true: some free implementations have features not available commercially.)

This FAQ concentrates on ‘free’ distributions of \TeX , but we do at least list the major vendors (see question 55).

18 What is the future of \TeX ?

Knuth has declared that he will do no further development of \TeX ; he will continue to fix any bugs that are reported to him (though bugs are rare). This decision was made soon after \TeX version 3.0 was released; at each bug-fix release the version number acquires one more digit, so that it tends to the limit π (at the time of writing, Knuth’s latest release is version 3.14159). Knuth wants \TeX to be frozen at version π when he dies; thereafter, no further changes may be made to Knuth’s source. (A similar rule is applied to METAFONT; its version number tends to the limit e , and currently stands at 2.718.)

There are projects (some of them long-term projects: see, for example, question 235) to build substantial new macro packages based on \TeX . For the even longer term, there are various projects to build a *successor* to \TeX ; see questions 236 and 237.

19 Reading (La) \TeX files

So you’ve been sent a \TeX file: what are you going to do with it? Well, the good news is that \TeX systems are available, free, for most sorts of computer; the bad news is that you need a pretty complete \TeX system even to read a single file, and complete \TeX systems are pretty large.

\TeX is a typesetting system that arose from a publishing project (see question 1), and its basic source is available free from its author. However, at its root, it is *just* a typesetting engine: even to view or to print the typeset output, you will need ancillary programs. In short, you need a \TeX *distribution* — a collection of \TeX -related programs tailored to your operating system: for details of the sorts of things that are available, see question 53 or 55 (for commercial distributions).

But beware — \TeX makes no attempt to look like the sort of WYSIWYG system you’re probably used to (see question 20): while many modern versions of \TeX have a compile-view cycle that rivals the best commercial word processors in its responsiveness, what you type is usually *mark-up*, which typically defines a logical (rather than a visual) view of what you want typeset.

However, in this context markup proves to be a blessing in disguise: a good proportion of most \TeX documents is immediately readable in an ordinary text editor. So, while you need to install a considerable system to attain the full benefits of the \TeX document that you were sent, the chances are you can understand quite a bit of it with nothing more than the ordinary tools you already have on your computer.

20 Why is \TeX not a wysiwyg system?

WYSIWYG is a marketing term (“What you see is what you get”) for a particular style of text processor. WYSIWYG systems are characterised by two principal claims: that you type what you want to print, and that what you see on the screen as you type is a close approximation to how your text will finally be printed.

The simple answer to the question is, of course, that \TeX was conceived long before the marketing term, at a time when the marketing imperative wasn’t perceived as significant. However, that was a long time ago: why has nothing been done with the “wonder text processor” to make it fit with modern perceptions?

There are two answers to this. First, the simple “things *have* been done” (but they’ve not taken over the \TeX world); and second, “there are philosophical reasons why the way \TeX has developed is ill-suited to the WYSIWYG style”.

A celebrated early approach at “WYSIWYG using \TeX ” was the Vor \TeX project: a pair of (early) Sun workstations worked in tandem, one handling the user interface while the other beavered away in the background typesetting the result. Vor \TeX was quite impressive for its time, but the two workstations combined had hugely less power

than the average sub-thousand dollar Personal Computer nowadays, and its code has not proved portable (it never even made the last ‘great’ $\text{T}_{\text{E}}\text{X}$ version change, at the turn of the 1990s, to $\text{T}_{\text{E}}\text{X}$ version 3). Modern systems that are similar in their approach are Lightning Textures (an extension of Blue Sky’s original $\text{T}_{\text{E}}\text{X}$ system for the Macintosh), and Scientific Word (which can also cooperate with a computer algebra system); both these systems are commercially available (see question 55). The free LyX system works with many free distributions of $\text{T}_{\text{E}}\text{X}$ and also offers a good approximation to WYSIWYG behaviour.

Nevertheless, many $\text{T}_{\text{E}}\text{X}$ users prefer the behaviour of a slick shell (or powerful editor) coupled with a fast $\text{T}_{\text{E}}\text{X}$ system: in the tedious arguments which rage on newsgroup `comp.text.tex` about which system is “best”, the principle contenders seem to be *emacs* and *winedt*; this author (who seldom uses anything other than *emacs*, through a combination of historical accident and lethargy) is ill-qualified to judge the merits of other systems.

The $\text{T}_{\text{E}}\text{X}$ world has taken a long time to latch onto the idea of WYSIWYG. Apart from simple arrogance (“we’re better, and have no need to consider the petty doings of the commercial word processor market”), there is a real conceptual difference between the word processor model of the world and the model $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ and $\text{C}\text{o}\text{n}\text{T}_{\text{E}}\text{X}\text{t}$ employ — the idea of “markup”. “Pure” markup expresses a logical model of a document, where every object within the document is labelled according to what it is rather than how it should appear: appearance is deduced from the properties of the type of object. Properly applied, markup can provide valuable assistance when it comes to re-use of documents.

Established WYSIWYG systems find the expression of this sort of structured markup difficult; however, markup *is* starting to appear in the lists of the commercial world’s requirements, for two reasons. First, an element of markup helps impose style on a document, and commercial users are increasingly obsessed with uniformity of style; and second, the increasingly pervasive use of XML-derived document archival formats demands it. The same challenges must needs be addressed by programs such as LyX, so we are observing a degree of confluence of the needs of the two communities: interesting times may be ahead of us.

21 $\text{T}_{\text{E}}\text{X}$ User Groups

There has been a $\text{T}_{\text{E}}\text{X}$ User Group since very near the time $\text{T}_{\text{E}}\text{X}$ first appeared. That first group, TUG, is still active and its journal *TUGboat* continues in publication (4 issues a year) with articles about $\text{T}_{\text{E}}\text{X}$, METAFONT and related technologies, and about document design, processing and production. TUG holds a yearly conference, whose proceedings are published in *TUGboat*.

TUG’s web site is a valuable resource for all sorts of $\text{T}_{\text{E}}\text{X}$ -related matters, such as details of $\text{T}_{\text{E}}\text{X}$ software, and lists of $\text{T}_{\text{E}}\text{X}$ vendors and $\text{T}_{\text{E}}\text{X}$ consultants. Back articles from *TUGboat* are slowly (subject to copyright issues, etc.) making their way to the site, too.

Some time ago, TUG established a “technical council”, whose task was to oversee the development of $\text{T}_{\text{E}}\text{X}$ projects. Most such projects nowadays go on their way without any support from TUG, but TUG’s web site lists its Technical Working Groups (TWGs: see <http://www.tug.org/twg.html>).

TUG has a reasonable claim to be considered a world-wide organisation, but there are many national and regional user groups, too; TUG’s web site maintains a list of “local user groups” (LUGs: see <http://www.tug.org/lugs.html>).

Contact TUG itself via:

$\text{T}_{\text{E}}\text{X}$ Users Group
1466 NW Front Avenue, Suite 3141
Portland, OR 97209
USA
Tel: +1 503-223-9994
Fax: +1 503-223-3960
Email: tug@mail.tug.org
Web: <http://www.tug.org/>

C Documentation and Help

22 Books on $\text{T}_{\text{E}}\text{X}$ and its relations

While Knuth’s book is the definitive reference for $\text{T}_{\text{E}}\text{X}$, there are other books covering $\text{T}_{\text{E}}\text{X}$:

The $\text{T}_{\text{E}}\text{X}$ book by Donald Knuth (Addison-Wesley, 1984, ISBN 0-201-13447-0, paperback ISBN 0-201-13448-9)

A Beginner’s Book of $\text{T}_{\text{E}}\text{X}$ by Raymond Seroul and Silvio Levy, (Springer Verlag, 1992, ISBN 0-387-97562-4)

$\text{T}_{\text{E}}\text{X}$ by Example: A Beginner’s Guide by Arvind Borde (Academic Press, 1992, ISBN 0-12-117650-9 — now out of print)

Introduction to $\text{T}_{\text{E}}\text{X}$ by Norbert Schwarz (Addison-Wesley, 1989, ISBN 0-201-51141-X — now out of print)

A Plain $\text{T}_{\text{E}}\text{X}$ Primer by Malcolm Clark (Oxford University Press, 1993, ISBNs 0-198-53724-7 (hardback) and 0-198-53784-0 (paperback))

$\text{T}_{\text{E}}\text{X}$ by Topic by Victor Eijkhout (Addison-Wesley, 1992, ISBN 0-201-56882-9 — now out of print, but see question 27)

$\text{T}_{\text{E}}\text{X}$ for the Beginner by Wynter Snow (Addison-Wesley, 1992, ISBN 0-201-54799-6)

$\text{T}_{\text{E}}\text{X}$ for the Impatient by Paul W. Abrahams, Karl Berry and Kathryn A. Hargreaves (Addison-Wesley, 1990, ISBN 0-201-51375-7)

$\text{T}_{\text{E}}\text{X}$ in Practice by Stephan von Bechtolsheim (Springer Verlag, 1993, 4 volumes, ISBN 3-540-97296-X for the set, or Vol. 1: ISBN 0-387-97595-0, Vol. 2: ISBN 0-387-97596-9, Vol. 3: ISBN 0-387-97597-7, and Vol. 4: ISBN 0-387-97598-5)

³That’s ‘Starting from Square One’

*TEX: Starting from [1]*³ by Michael Doob (Springer Verlag, 1993, ISBN 3-540-56441-1 — now out of print)

The Advanced TEXbook by David Salomon (Springer Verlag, 1995, ISBN 0-387-94556-3)

A collection of Knuth's publications about typography has recently been published:

Digital Typography by Donald Knuth (CSLI and Cambridge University Press, 1999, ISBN 1-57586-011-2, paperback ISBN 1-57586-010-4).

and in late 2000, a "Millennium Boxed Set" of all 5 volumes of Knuth's "Computers and Typesetting" series (about \TeX and METAFONT) was published by Addison Wesley:

Computers & Typesetting, Volumes A–E Boxed Set by Donald Knuth (Addison-Wesley, 2001, ISBN 0-201-73416-8).

For \LaTeX , see:

LaTeX, a Document Preparation System by Leslie Lamport (second edition, Addison Wesley, 1994, ISBN 0-201-52983-1)

A guide to LaTeX Helmut Kopka and Patrick W. Daly (third edition, Addison-Wesley, 1998, ISBN 0-201-39825-7)

The LaTeX Companion by Michel Goossens, Frank Mittelbach, and Alexander Samarin (Addison-Wesley, 1993, ISBN 0-201-54199-8)

The LaTeX Graphics Companion: Illustrating documents with TEX and PostScript by Michel Goossens, Sebastian Rahtz and Frank Mittelbach (Addison-Wesley, 1997, ISBN 0-201-85469-4)

The LaTeX Web Companion Integrating TEX, HTML and XML by Michel Goossens and Sebastian Rahtz (Addison-Wesley, 1999, ISBN 0-201-43311-7)

TEX Unbound: LaTeX and TEX strategies for fonts, graphics, and more by Alan Hoenig (Oxford University Press, 1998, ISBN 0-19-509685-1 hardback, ISBN 0-19-509686-X paperback)

Math into LaTeX: An Introduction to LaTeX and AMS-LaTeX by George Grätzer (third edition Birkhäuser and Springer Verlag, 2000, ISBN 0-8176-4431-9, ISBN 3-7643-4131-9)

A list of errata for the first printing is available from: <http://www.springer-ny.com/catalog/np/jan99np/0-387-98708-8.html>

First Steps in LaTeX by George Grätzer (Birkhäuser, 1999, ISBN 0-8176-4132-7)

LaTeX: Line by Line: Tips and Techniques for Document Processing by Antoni Diller (second edition, John Wiley & Sons, 1999, ISBN 0-471-97918-X)

LaTeX for Linux: A Vade Mecum by Bernice Sacks Lipkin (Springer-Verlag, 1999, ISBN 0-387-98708-8, second printing)

A sample of George Grätzer's book, in Adobe Acrobat format, is also available (info/mil/mil.pdf).

Example files for the \LaTeX Graphics and Web Companions are available in info/lgc (Graphics) and info/lwc (Web). Example files for George Grätzer's 'First Steps' are available in info/FirstSteps

The list for METAFONT is rather short:

The METAFONTbook by Donald Knuth (Addison Wesley, 1986, ISBN 0-201-13445-4, ISBN 0-201-52983-1 paperback)

Alan Hoenig's '*TEX Unbound*' includes some discussion and examples of using METAFONT.

This list only covers books in English: UK TUG cannot hope to maintain a list of books in languages other than our own.

23 Books on Type

The following is a partial listing of books on typography in general. Of these, Bringhurst seems to be the one most often recommended.

The Elements of Typographic Style by Robert Bringhurst (Hartley & Marks, 1992, ISBN 0-88179-033-8)

Finer Points in the Spacing & Arrangement of Type by Geoffrey Dowding (Hartley & Marks, 1996, ISBN 0-88179-119-9)

The Thames & Hudson Manual of Typography by Ruari McLean (Thames & Hudson, 1980, ISBN 0-500-68022-1)

The Form of the Book by Jan Tschichold (Lund Humphries, 1991, ISBN 0-85331-623-6)

Type & Layout by Colin Wheildon (Strathmore Press, 1995, ISBN 0-9624891-5-8)

The Design of Books by Adrian Wilson (Chronicle Books, 1993, ISBN 0-8118-0304-X)

There are many catalogues of type specimens but the following books provide a more interesting overall view of types in general and some of their history.

Alphabets Old & New by Lewis F. Day (Senate, 1995, ISBN 1-85958-160-9)

An Introduction to the History of Printing Types by Geoffrey Dowding (British Library, 1998, UK ISBN 0-7123-4563-9; USA ISBN 1-884718-44-2)

The Alphabet Abecedarium by Richar A. Firmage (David R. Godine, 1993, ISBN 0-87923-998-0)

The Alphabet and Elements of Lettering by Frederick Goudy (Dover, 1963, ISBN 0-486-20792-7)

Anatomy of a Typeface by Alexander Lawson (David R. Godine, 1990, ISBN 0-87923-338-8)

A Tally of Types by Stanley Morison (David R. Godine, 1999, ISBN 1-56792-004-7)

Counterpunch by Fred Smeijers (Hyphen, 1996, ISBN 0-907259-06-5)

Treasury of Alphabets and Lettering by Jan Tschichold (W. W. Norton, 1992, ISBN 0-393-70197-2)

A Short History of the Printed Word by Warren Chappell and Robert Bringhurst (Hartley & Marks, 1999, ISBN 0-88179-154-7)

The above lists are limited to books published in English. Typographic styles are somewhat language-dependent, and similarly the ‘interesting’ fonts depend on the particular writing system involved.

24 Where to find FAQs

Bobby Bodenheimer’s article, from which this FAQ was developed, used to be posted (nominally monthly) to newsgroup `comp.text.tex` and cross-posted to newsgroups `news.answers` and `comp.answers`. The (long obsolete) last posted copy of that article is kept on CTAN for auld lang syne; it is no longer kept in the `news.answers` archives.

A version of the present FAQ may be browsed via the World-Wide Web, at URL <http://www.tex.ac.uk/faq>, and its sources are available from CTAN.

Another excellent information source, available in English, is the (L)T_EX navigator (see <http://tex.loria.fr>).

Both the Francophone T_EX usergroup Gutenberg and the Czech/Slovak usergroup CS-TUG have published translations of this FAQ, with extensions appropriate to their languages.

Other non-English FAQs are available:

German Posted regularly to `de.comp.tex`, and archived on CTAN; the FAQ also appears at <http://www.dante.de/faq/de-tex-faq/>

French Posted regularly to `fr.comp.text.tex`, and archived on CTAN.

Spanish See <http://apolo.us.es/CervanTeX/FAQ/>

Czech See <http://www.fi.muni.cz/cstug/csfaq/>

Dante FAQ: `usergrps/dante/de-tex-faq`

French FAQ: `help/LaTeX-FAQ-francaise`

Sources of this FAQ: `help/uk-tex-faq`

Obsolete comp.text.tex FAQ: `obsolete/help`

25 Where to get help

First ... read any FAQ you can find. (Which is what you’re doing now, isn’t it?)

An ambitious FAQ-like project to collect all T_EX-related information into one place is under way at <http://www.ctv.es/USERS/irmina/TeEncontreX.html>; as with any FAQ, this project needs the support and help of all users — as yet, it carries an incomplete set of answers to potential questions. The sources of the package (including a complete set of `html` files) are available: `info/spanish/TeEncontreX`

The tutorials and other on-line documentation (see question 27) can get you started but for more in-depth understanding you should get and read at least one of the many good books on the subject (see question 22). The definitive source for (L)T_EX is the source code itself, but that is not something to be approached lightly (if at all).

If you are seeking a particular package or program, look on your own system first: you might already have

it — the better T_EX distributions contain a wide range of supporting material.

If you have access to the internet, and in particular newsgroups, then (L)T_EX discussions, including METAFONT and MetaPost, are on `comp.text.tex`. It is best to spend a little time familiarising yourself with the current threads before asking a question. The group is normally very responsive but asking a question that has just been answered is likely to dampen people’s enthusiasm to help you.

<http://groups.google.com/> archives Usenet news discussions, and `comp.text.tex` may be found there. Google’s archive now goes impressively far back in time (before `comp.text.tex` even existed), and it is a powerful resource for tracking down that recommendation that no-one can now remember. Google also now allows you to post your own questions or followups.

The few people who can’t use the World Wide Web, can’t access Usenet news, but can use electronic mail can seek help through mailing lists.

The T_EXhax digest is nowadays operated as a moderated “MailMan” mailing list: its members now have the option of receiving messages in ‘real time’, and answers are more quickly forthcoming than ever they were in the past. Subscribe via <http://lists.nottingham.ac.uk/mailman/listinfo/texhax>; past digests are available on CTAN.

Many mailing lists exist that cover some small part of the T_EX arena. A good source of pointers is <http://www.tug.org/>

Announcements of T_EX-related installations on the CTAN archives are sent to the mailing list `ctan-ann`. Subscribe to the list by sending a message ‘`subscribe ctan-ann <your email address>`’ to `majordomo@dante.de`

Issues related to METAFONT (and, increasingly, MetaPost) are discussed on the `metafont` mailing list; subscribe by sending a message ‘`subscribe metafont <your name>`’ to `listserv@ens.fr`

A few other T_EX-related lists may be accessed via `listserv@urz.uni-heidelberg.de`. Send a message containing the line ‘`help`’ to this address, or browse <http://listserv.uni-heidelberg.de/cgi-bin/wa>

T_EXhax digests: Browse `digests/texhax`

26 How to ask a question

You want help from the community at large; you’ve decided where you’re going to ask your question (see question 25), but how do you phrase it?

Excellent “general” advice (how to ask questions of anyone) is contained in Eric Raymond’s article on the topic (see <http://www.tuxedo.org/~esr/faqs/smart-questions.html>). Eric’s an extremely self-confident person, and this comes through in his advice; but his guidelines are very good, even for us in the un-self-confident majority. It’s important to remember that you don’t have a right to advice from the world, but that if you express yourself well, you will usually find someone who will be pleased to help.

So how do you express yourself in the (L^A)T_EX world? There aren't any comprehensive rules, but a few guidelines may help in the application of your own common sense.

1. Make sure you're asking the right people. Don't ask in a T_EX forum about printer device drivers for the *Foo*bar operating system. Yes, T_EX users need printers, but no, T_EX users will typically *not* be *Foo*bar systems managers. Similarly, avoid posing a question in a language that the majority of the group don't use: post in Ruritanian to `de.comp.text.tex` and you may have a long wait before a German- and Ruritanian-speaking T_EX expert notices your question.
2. If you need to know how to do something, make clear what your environment is. "I want to do x in Plain T_EX", or "I want to do y in L^AT_EX running the *boggle* class".
3. If something's going wrong, pretend you're submitting a L^AT_EX bug report (see question 243), and try to generate a minimum failing example. If your example needs your local *xyzthesis* class, or some other resource not generally available, be sure to include a pointer to how the resource can be obtained.
4. Be as succinct as possible. Your helpers probably don't need to know *why* you're doing something, just *what* you're doing and where the problem is.

27 (L^A)T_EX Tutorials, etc.

Some very fine tutorials have been written, over the years. Michael Doob's splendid 'Gentle Introduction' to Plain T_EX has been stable for a very long time.

More dynamic is Tobias Oetiker's '(Not so) Short Introduction to L^AT_EX 2_ε', which is regularly updated, as people suggest better ways of explaining things, etc. The introduction has been translated into several languages other than its original English.

Harvey Greenberg's 'Simplified Introduction to L^AT_EX' was written for a lecture course, and is available on CTAN (in PostScript only, unfortunately).

Peter Flynn's 'Beginner's L^AT_EX' (see <http://www.silmaril.ie/documents/beginlatex.pdf>) isn't yet (April 2002) complete, but is another pleasing read. It too started as course material.

The AMS publishes a "Short Math Guide for L^AT_EX", which is available (in several formats) via <http://www.ams.org/tex/short-math-guide.html>

Reference material is somewhat more difficult to come by. A sterling example is set by David Bausum's list of T_EX primitives (see <http://www.tug.org/utilities/plain/cseq.html>).

Some university departments make their local documentation available on the web. Most straightforwardly, there's the simple translation of existing documentation into HTML, for example the INFO documentation of the (L^A)T_EX installation, of which a sample is the L^AT_EX documentation available at [http://www.tac.dk/cgi-bin/info2www?\(latex\)](http://www.tac.dk/cgi-bin/info2www?(latex))

More ambitiously, some departments have enthusiastic documenters who make public record of their (L^A)T_EX support. For example, Tim Love (of Cambridge University

Engineering Department) maintains his department's excellent pages <http://www-h.eng.cam.ac.uk/help/tpl/textprocessing/>

Another summary by command (somewhat akin to David Basum's work for Plain T_EX) is to be found at <http://www.giss.nasa.gov/latex/ltx-2.html>

People have long argued for (L^A)T_EX books to be made available on the web, and Victor Eijkhout's excellent "T_EX by Topic" (previously published by Addison-Wesley, but long out of print) was offered in this way a Christmas 2001. The book is currently available on a shareware basis at <http://www.eijkhout.net/tbt/>; it's not a beginner's tutorial but it's a fine reference (and well worth the suggested contribution).

Gentle Introduction: <info/gentle/gentle.pdf>

Not so Short Introduction:

<info/lshort/english/lshort.pdf>

Simplified L^AT_EX: <info/simplified-latex/latex.ps>

28 Learning to write L^AT_EX classes and packages

There's nothing particularly magic about the commands you use when writing a package, so you can simply bundle up a set of L^AT_EX `\(re)newcommand` and `\(re)newenvironment` commands, put them in a file `package.sty` and you have a package.

However, any but the most trivial package will require rather more sophistication. Some details of L^AT_EX commands for the job are to be found in 'L^AT_EX 2_ε for class and package writers' (<http://www.tex.ac.uk/tex-archive/macros/latex/doc/html/clsguide>: the L^AT_EX source of this document appears in the L^AT_EX distribution). Beyond this, a good knowledge of T_EX itself is valuable. With such knowledge it is possible to use the documented source of L^AT_EX as reference material (dedicated authors will acquaint themselves with the source as a matter of course). A complete set of the documented source of L^AT_EX may be prepared by processing the file `source2e.tex` in the L^AT_EX distribution.

Writing good classes is not easy; it's a good idea to read some established ones (`classes.dtx`, for example, produces the standard classes other than *letter*, and may itself be formatted with L^AT_EX). Classes that are not part of the distribution are commonly based on ones that are, and start by loading the standard class with `\LoadClass` — an example of this technique may be seen in `ltxguide.cls`

`classes.dtx`: `macros/latex/base/classes.dtx`

`ltxguide.cls`: `macros/latex/base/ltxguide.cls`

`source2e.tex`: `macros/latex/base/source2e.tex`

29 METAFONT and MetaPost Tutorials

Unfortunately there appear to be no tutorials on how to use METAFONT, except for the information provided by Knuth. There are, though, a couple of articles on how to run both METAFONT and MetaPost.

Geoffrey Tobin has provided *METAFONT for Beginners* (see question 78). This describes how the METAFONT system works and how to avoid some of the potential pitfalls.

Peter Wilson's *Some Experiences in Running METAFONT and MetaPost* offers the benefit of Peter's experience (he has designed a number of 'historical' fonts using METAFONT). On the METAFONT side the article is more geared towards testing and installing new METAFONT fonts than on the system, while on the other side it describes how to use MetaPost illustrations in L^AT_EX and PDFL^AT_EX documents, with an emphasis on how to use appropriate fonts for any text or mathematics.

Hans Hagen (of ConT_EXt fame) offers a MetaPost tutorial called MetaFun (which admittedly concentrates on the use of MetaPost with in ConT_EXt). It may be found on his company's MetaPost page (see <http://www.ntg.nl/context/metapost.htm>).

Beginners' guide: `info/metafont-for-beginners.tex`

Peter Wilson's "experiences": `info/metafp.ps`
(PostScript) or `info/metafp.pdf` (PDF format)

30 BibT_EX Documentation

BIBT_EX, a program originally designed to produce bibliographies in conjunction with L^AT_EX, is explained in Section 4.3 and Appendix B of Leslie Lamport's L^AT_EX manual (see question 22). The document "BIBT_EXing", contained in the file `btxdoc.tex`, gives a more complete description. *The L^AT_EX Companion* (see question 22) also has information on BIBT_EX and writing BIBT_EX style files.

The document "Designing BIBT_EX Styles", contained in the file `btXHak.tex`, explains the postfix stack-based language used to write BIBT_EX styles (`.bst` files). The file `btXbst.doc` is the template for the four standard styles (`plain`, `abbrv`, `alpha`, `unsrt`). It also contains their documentation. The complete BIBT_EX documentation set (including the files above) is available on CTAN.

There is a Unix BIBT_EX *man* page in the *web2c* package (see question 53). Any copy you may find of a *man* page written in 1985 (before "BIBT_EXing" and "Designing BIBT_EX Styles" appeared) is obsolete, and should be thrown away.⁴

BIBT_EX documentation: `biblio/bibtex/distrib/doc`

31 Where can I find the symbol for...

There is a wide range of symbols available for use with T_EX, most of which are not shown (or even mentioned) in (L^A)T_EX books. *The Comprehensive L^AT_EX Symbol List* (by Scott Pakin *et al.*) illustrates over 2000 symbols, and details the commands and packages needed to produce them.

Other questions in this FAQ offer specific help on kinds of symbols:

- Script fonts for mathematics (question 180)
- Fonts for the number sets (question 179)
- Typesetting the principal value integral (question 182)

Symbol List: Browse `info/symbols/comprehensive`; there are processed versions in both PostScript and PDF forms for both A4 and letter paper.

32 The P_IC_TE_X manual

P_IC_TE_X is a set of macros by Michael Wichura for drawing diagrams and pictures. The macros are freely available; however, the P_IC_TE_X manual itself is not free. Unfortunately, TUG is no longer able to supply copies of the manual (as it once did), and it is now available only through Personal T_EX Inc, the vendors of P_CT_EX (<http://www.pctex.com/>). The manual is *not* available electronically.

pictex: `graphics/pictex`

D Bits and pieces of T_EX

33 What is a DVI file?

A DVI file (that is, a file with the type or extension `.dvi`) is T_EX's main output file, using T_EX in its broadest sense to include L^AT_EX, etc. 'DVI' is supposed to be an acronym for DeVice-Independent, meaning that the file can be printed on almost any kind of typographic output device. The DVI file is designed to be read by a driver (see question 34) to produce further output designed specifically for a particular printer (e.g., a LaserJet) or to be used as input to a previewer for display on a computer screen. DVI files use T_EX's internal coding; a T_EX input file should produce the same DVI file regardless of which implementation of T_EX is used to produce it.

A DVI file contains all the information that is needed for printing or previewing except for the actual bitmaps or outlines of fonts, and possibly material to be introduced by means of `\special` commands (see question 38).

The canonical reference for the structure of a DVI file is the source of *dvitype*.

dvitype: `systems/knuth/texware/dvitype.web`

34 What is a driver?

A driver is a program that takes as input a DVI file (see question 33) and (usually) produces a file that can be sent to a typographic output device, called a printer for short.

A driver will usually be specific to a particular printer, although any PostScript printer ought to be able to print the output from a PostScript driver.

As well as the DVI file, the driver needs font information. Font information may be held as bitmaps or as outlines, or simply as a set of pointers into the fonts that the printer itself 'has'. Each driver will expect the font information in a particular form. For more information on the forms of fonts, see questions 35, 36, 37 and 82.

⁴Or submitted for inclusion in a museum dedicated to the history of computing: the stricture was conceivably reasonable in the first version of this FAQ...

35 What are PK files?

PK files (packed raster) contain font bitmaps. The output from METAFONT (see question 78) includes a generic font (GF) file and the utility *gftopk* produces the PK file from that. There are a lot of PK files, as one is needed for each font, that is each magnification (size) of each design (point) size for each weight for each family. Further, since the PK files for one printer do not necessarily work well for another, the whole set needs to be duplicated for each printer type at a site. As a result, they are often held in an elaborate directory structure, or in ‘font library files’, to regularise access.

36 What are TFM files?

TFM stands for T_EX font metrics, and TFM files hold information about the sizes of the characters of the font in question, and about ligatures and kerns within that font. One TFM file is needed for each font used by T_EX, that is for each design (point) size for each weight for each family; one TFM file serves for all magnifications, so that there are (typically) fewer TFM files than there are PK files. The important point is that TFM files are used by T_EX (L^AT_EX, etc.), but are not, generally, needed by the printer driver.

37 Virtual fonts

Virtual fonts for T_EX were first implemented by David Fuchs in the early days of T_EX, but for most people they started when Knuth redefined the format, and wrote some support software, in 1989 (he published an article in *TUGboat* at the time, and a copy is available on CTAN). Virtual fonts provide a way of telling T_EX about something more complicated than just a one-to-one character mapping. The entities you define in a virtual font look like characters to T_EX (they appear with their sizes in a font metric file), but the DVI processor may expand them to something quite different. You can use this facility just to remap characters, to make a composite font with glyphs drawn from several sources, or to build up an effect in arbitrarily complicated ways — a virtual font may contain anything which is legal in a DVI file. In practice, the most common use of virtual fonts is to remap PostScript fonts (see question 84) or to build ‘fake’ maths fonts.

It is important to realise that T_EX itself does *not* see virtual fonts; for every virtual font read by the DVI driver there is a corresponding TFM file read by T_EX. Virtual fonts are normally created in a single ASCII *vp1* (Virtual Property List) file, which includes both sets of information. The *vptovf* program is then used to create the binary TFM and VF files. The commonest way (nowadays) of generating *vp1* files is to use the *fontinst* package, which is described in detail in question 84. *qdtexvpl* is another utility for creating ad-hoc virtual fonts.

fontinst: fonts/utilities/fontinst

Knuth on virtual fonts: info/virtual-fonts.knuth

qdtexvpl: fonts/utilities/qdtexvpl

38 \special commands

T_EX provides the means to express things that device drivers can do, but about which T_EX itself knows nothing. For example, T_EX itself knows nothing about how to

include PostScript figures into documents, or how to set the colour of printed text; but some device drivers do.

Such things are introduced to your document by means of \special commands; all that T_EX does with these commands is to expand their arguments and then pass the command to the DVI file. In most cases, there are macro packages provided (often with the driver) that provide a comprehensible interface to the \special; for example, there’s little point including a figure if you leave no gap for it in your text, and changing colour proves to be a particularly fraught operation that requires real wizardry. L^AT_EX 2_ε has standard graphics and colour packages that make file inclusion, rotation, scaling and colour via \specials all easy.

The allowable arguments of \special depend on the device driver you’re using. Apart from the examples above, there are \special commands in the emT_EX drivers (e.g., *dvihplj*, *dviscr*, etc.) that will draw lines at arbitrary orientations, and commands in *dvitoln03* that permit the page to be set in landscape orientation.

39 Documented L^AT_EX sources (.dtx files)

L^AT_EX 2_ε, and many support macro packages, are now written in a literate programming style (see question 64), with source and documentation in the same file. This format, known as ‘doc’, was originated by Frank Mittelbach. The documented sources conventionally have the suffix *.dtx*, and should normally be stripped of documentation before use with L^AT_EX. Alternatively you can run L^AT_EX on a *.dtx* file to produce a nicely formatted version of the documented code. An installation script (with suffix *.ins*) is usually provided, which needs the standard L^AT_EX 2_ε *docstrip* package (among other things, the installation process strips all the comments that make up the documentation for speed when loading the file into a running L^AT_EX system). Several packages can be included in one *.dtx* file, with conditional sections, and there facilities for indices of macros etc. Anyone can write *.dtx* files; the format is explained in *The L^AT_EX Companion* (see question 22). There are no programs yet to assist in composition.

.dtx files are not used by L^AT_EX after they have been processed to produce *.sty* or *.cls* (or whatever) files. They need not be kept with the working system; however, for many packages the *.dtx* file is the primary source of documentation, so you may want to keep *.dtx* files elsewhere.

40 What are encodings?

Let’s start by defining two concepts, the character and the glyph. The character is the abstract idea of the ‘atom’ of a language or other dialogue: so it might be a letter in an alphabetic language, a syllable in a syllabic language, or an ideogram in an ideographic language. The glyph is the mark created on screen or paper which represents a character. Of course, if reading is to be possible, there must be some agreed relationship between the glyph and the character, so while the precise shape of the glyph can be affected by many other factors, such as the capabilities of the writing medium and the designer’s style, the essence of the underlying character must be retained.

Whenever a computer has to represent characters, someone has to define the relationship between a set of numbers and the characters they represent. This is the essence of an encoding: it is a mapping between a set of numbers and a set of things to be represented.

\TeX of course deals in encoded characters all the time: the characters presented to it in its input are encoded, and it emits encoded characters in its DVI (or PDF) output. These encodings have rather different properties.

The \TeX input stream was pretty unruly back in the days when Knuth first implemented the language. Knuth himself prepared documents on terminals that produced all sorts of odd characters, and as a result \TeX contains some provision for translating the input encoding to something regular. Nowadays, the operating system translates keystrokes into a code appropriate for the user's language: the encoding used is often a national or international standard, though many operating systems use "code pages" defined by MicroSoft. These standards and code pages often contain characters that can't appear in the \TeX system's input stream. Somehow, these characters have to be dealt with — so an input character like "é" needs to be interpreted by \TeX in a way that that at least mimics the way it interprets "\'e".

The \TeX output stream is in a somewhat different situation: characters in it are to be used to select glyphs from the fonts to be used. Thus the encoding of the output stream is notionally a font encoding (though the font in question may be a virtual one — see question 37). In principle, a fair bit of what appears in the output stream could be direct transcription of what arrived in the input, but the output stream also contains the product of commands in the input, and translations of the input such as ligatures like `fi` ⇒ "fi".

Font encodings became a hot topic when the Cork encoding (see question 42) appeared, because of the possibility of suppressing the use of `\accent` commands in the output stream (and hence improving the quality of the hyphenation of text in inflected languages, which is interrupted by the `\accent` commands — see question 41). To take advantage of the diacriticised characters represented in the fonts, it is necessary to arrange that whenever the command sequence command sequence "\'e" has been input (explicitly, or implicitly via the sort of mapping of input mentioned above), the character that codes the position of the "é" glyph is used.

Thus we could have the odd arrangement that the diacriticised character in the \TeX input stream is translated into \TeX commands that would generate something looking like the input character; this sequence of \TeX commands is then translated back again into a single diacriticised glyph as the output is created. This is in fact precisely what the \LaTeX packages *inputenc* and *fontenc* do, if operated in tandem on (most) characters in the ISO Latin-1 input encoding and the T1 font encoding. At first sight, it seems eccentric to have the first package do a thing, and the second precisely undo it, but it doesn't always happen that way: most font encodings can't match the corresponding input encoding nearly so well, and the two packages provide the sort of symmetry the \LaTeX system needs.

41 How does hyphenation work in \TeX ?

Everyone knows what hyphenation is: we see it in most books we read, and (if we're alert) often spot ridiculous mis-hyphenation from time to time (at one time, British newspapers were a fertile source).

Hyphenation styles are culturally-determined, and the same language may be hyphenated differently in different countries — for example, even British and American styles of hyphenation of English are very different. As a result, a typesetting system that is not restricted to a single language at a single locale needs to be able to change its hyphenation rules from time to time.

\TeX uses a pretty good system for hyphenation (originally designed by Frank Liang), and while it's capable of missing "sensible" hyphenation points, it seldom selects grossly wrong ones. The algorithm matches candidates for hyphenation against a set of "hyphenation patterns". The candidates for hyphenation must be sequences of letters (or other single characters that \TeX may be persuaded to think of as letters) — things such as \TeX 's `\accent` primitive interrupt hyphenation.

Sets of hyphenation patterns are usually derived from analysis of a list of valid hyphenations (the process of derivation, using a tool called *patgen*, is not ordinarily a participatory sport).

The patterns for the languages a \TeX system is going to deal with may only be loaded when the system is installed. To change the set of languages, a partial reinstallation (see question 174) is necessary.

\TeX provides two "user-level" commands for control of hyphenation: `\language` (which selects a hyphenation style), and `\hyphenation` (which gives explicit instructions to the hyphenation engine, overriding the effect of the patterns).

The ordinary \LaTeX user need not worry about `\language`, since it is very thoroughly managed by the *babel* package; use of `\hyphenation` is discussed in question 170.

42 What are the EC fonts?

A font consists of a number of *glyphs*. In order that the glyphs may be printed, they are *encoded* (see question 40), and the encoding is used as an index into tables within the font. For various reasons, Knuth chose deeply eccentric encodings for his Computer Modern family of fonts; in particular, he chose different encodings for different fonts, so that the application using the fonts has to remember which font of the family it's using before selecting a particular glyph.

When \TeX version 3 arrived, most of the excuses for the eccentricity of Knuth's encodings went away, and at TUG's Cork meeting, an encoding for a set of 256 glyphs, for use in \TeX text, was defined. The intention was that these glyphs should cover 'most' European languages that use Latin alphabets, in the sense of including all accented letters needed. (Knuth's CMR fonts missed things necessary for Icelandic, Polish and Sami, for example, but the Cork fonts have them. Even Cork's coverage isn't complete: it misses letters from Romanian and Welsh, at least.) \LaTeX refers to the Cork encoding as T1, and provides the means to use fonts thus encoded to avoid prob-

lems with the interaction of accents and hyphenation (see question 173).

The only METAFONT-fonts that conform to the Cork encoding are the EC fonts. They look CM-like, though their metrics differ from CM-font metrics in several areas. The fonts are now regarded as ‘stable’ (in the same sense that the CM fonts are stable: their metrics are unlikely ever to change). Their serious disadvantages for the casual user are their size (each EC font is roughly twice the size of the corresponding CM font), and the unavailability of free Adobe type 1 versions, so that PDF produced using them is inevitably bad (see question 75). (Note, however, that several commercial suppliers offer EC or EC-equivalent fonts in type 1 or TrueType form — see question 55.) What’s more, until corresponding fonts for mathematics are produced, the CM fonts must be retained because some mathematical symbols are drawn from text fonts in the CM encodings.

The EC fonts are distributed with a set of ‘Text Companion’ (TC) fonts that provide glyphs for symbols commonly used in text. The TC fonts are encoded according to the L^AT_EX TS1 encoding, and are not viewed as ‘stable’ in the same way as are the EC fonts are.

The Cork encoding is also implemented by virtual fonts provided in the PSNFSS system (see question 82), for PostScript fonts, and also by the *txfonts* and *pxfonts* font packages (see question 86).

EC and TC fonts: fonts/ec

43 What is the TDS?

TDS stands for the T_EX Directory Structure, which is a standard way of organising all the T_EX-related files on a computer system.

Most modern distributions conform to the TDS, which provides for both a ‘standard’ hierarchy and a ‘local’ hierarchy. The TDS reserves the name `texmf` as the name of the root directory (folder) of the hierarchies. Files supplied as part of the distribution are put into the standard hierarchy. The location of the standard hierarchy is system dependent, but on a Unix system it might be at `/usr/local/texmf`, or `/usr/local/share/texmf`, or `/opt/texmf`, or a similar location, but in each case the T_EX files will be under the `/texmf` subdirectory.

There can be multiple ‘local’ hierarchies in which additional files can be put. In the extreme an installation can have a local hierarchy and each user can also have an individual local hierarchy. The location of any local hierarchy is not only system dependent but also user dependent. Again, though, all files should be put under a local `/texmf` directory.

TDS specification: tds/draft-standard/tds-0.9996

44 What is “Encapsulated PostScript”

PostScript has over the years become a *lingua franca* of powerful printers; since PostScript is also a powerful graphical programming language, it is commonly used as an output medium for drawing (and other) packages.

However, since PostScript *is* such a powerful language, some rules need to be imposed, so that the output drawing may be included in a document as a figure without

“leaking” (and thereby destroying the surrounding document, or failing to draw at all).

Appendix H of the PostScript Language Reference Manual (second and subsequent editions), specifies a set of rules for PostScript to be used as figures in this way. The important features are:

- certain “structured comments” are required; important ones are the identification of the file type, and information about the “bounding box” of the figure (i.e., the minimum rectangle enclosing it);
- some commands are forbidden — for example, a `showpage` command will cause the image to disappear, in most T_EX-output environments; and
- “preview information” is permitted, for the benefit of things such as word processors that don’t have the ability to draw PostScript in their own right — this preview information may be in any one of a number of system-specific formats, and any viewing program may choose to ignore it.

A PostScript figure that conforms to these rules is said to be in “Encapsulated PostScript” format. Most (L^A)T_EX packages for including PostScript are structured to use Encapsulated PostScript; which of course leads to much hilarity as exasperated (L^A)T_EX users struggle to cope with the output of drawing software whose authors don’t know the rules.

E Acquiring the Software

45 Repositories of T_EX material

To aid the archiving and retrieval of T_EX-related files, a TUG working group developed the Comprehensive T_EX Archive Network (CTAN). Each CTAN site has identical material, and maintains authoritative versions of its material. These collections are extensive; in particular, almost everything mentioned in this FAQ is archived at the CTAN sites (see the lists of software at the end of the questions).

The CTAN sites are currently `dante.ctan.org` (Mainz, Germany), `cam.ctan.org` (Cambridge, UK) and `tug.ctan.org` (Colchester, Vermont, USA). The organisation of T_EX files on all CTAN sites is identical and starts at `tex-archive/`. Each CTAN node may also be accessed via the Web at URLs `http://www.dante.de/tex-archive`, `http://www.tex.ac.uk/tex-archive` and `http://www.ctan.org/tex-archive` respectively; not all CTAN mirrors are Web-accessible. As a matter of course, to reduce network load, please use the CTAN site or mirror closest to you. A complete and current list of CTAN sites and known mirrors can be obtained by using the *finger* utility on ‘user’ `ctan@cam.ctan.org`, `ctan@dante.ctan.org` or `ctan@tug.ctan.org`; it is also available as file `CTAN.sites`

For details of how to find files at CTAN sites, see questions 49 (searching by ftp) and 50 (Web searching).

The email servers `ftpmail@dante.ctan.org` and `ftpmail@tug.ctan.org` provide an ftp-like interface through mail. Send a message containing just the line ‘help’ to your nearest server, for details of use.

The T_EX user who has no access to any sort of network may buy a copy of the archive on CD-ROM (see question 52).

46 What's the CTAN nonfree tree?

The CTAN archives are currently restructuring their holdings so that files that are 'not free' are held in a separate tree. The definition of what is 'free' (for this purpose) is influenced by, but not exactly the same as the Debian Free Software Guidelines (DFSG: see http://www.debian.org/social_contract#guidelines).

Material is placed on the `nonfree` tree if it is not freely-usable (e.g., if the material is shareware, commercial, or if its usage is not permitted in certain domains at all, or without payment). Users of the archive should check that they are entitled to use material they have retrieved from the `nonfree` tree.

The Catalogue (one of the prime sources for finding T_EX-related material via web search — see question 50) lists the licence details in each entry in its lists. The catalogue also provides details of the licence categories, see its list of licences — see <http://www.tex.ac.uk/tex-archive/help/Catalogue/licenses.html>

47 Contributing a file to the archives

If you are able to use anonymous ftp, get yourself a copy of the file `README.uploads` from the root directory of any CTAN archive (see question 45). The file tells you where to upload, what to upload, and how to notify the CTAN management about what you want doing with your upload.

You may also upload via the Web: each of the principle CTAN sites offers an upload page — choose from <http://www.ctan.org/upload.html>, <http://www.dante.de/upload.html> or <http://www.tex.ac.uk/upload.html>; the pages lead you through the process, showing you the information you need to supply.

If you can use neither of these methods, ask advice of the CTAN management (ctan@dante.de): if the worst comes to the worst, it may be possible to mail a contribution.

You will make everyone's life easier if you choose a descriptive and unique name for your submission. Descriptiveness is in the eye of the beholder, but do try and be reasonable; and it's probably a good idea to check that your chosen name is not already in use by browsing the archive (see question 49), or the Catalogue (see question 50).

If it's appropriate (if your package is large, or regularly updated), the CTAN management can arrange to *mirror* your contribution direct into the archive. At present this may only be done if your contribution is available via ftp, and of course the directory structure on your archive must 'fit'.

48 Finding (L^A)T_EX macro packages

Before you ask for a T_EX macro or L^AT_EX class or package file to do something, try searching Graham Williams' catalogue. You can also search the catalogue over the web (see question 50).

If you have learnt of a file, by some other means, that seems interesting, search a CTAN archive for it (see ques-

tion 49). For packages listed in *The L^AT_EX Companion* (see question 22) the file may be consulted as an alternative to searching the archive's index. It lists the current location in the archive of such files.

Graham Williams' catalogue:

```
help/Catalogue/catalogue.html
```

```
companion.ctan: info/companion.ctan
```

49 Finding files in the CTAN archives

To find software at a CTAN site, you can use anonymous ftp to the host with the command 'quote site index <term>', or the searching script at <http://www.dante.de/cgi-bin/ctan-index>

To get the best use out of the ftp facility you should remember that <term> is a *Regular Expression* and not a fixed string, and also that many files are distributed in source form with an extension different to the final file. (For example L^AT_EX packages are often distributed sources with extension `dtx` rather than as package files with extension `sty`.)

One should make the regular expression general enough to find the file you are looking for, but not too general, as the ftp interface will only return the first 20 lines that match your request.

The following examples illustrate these points. To search for the L^AT_EX package 'caption', you might use the command:

```
quote site index caption.sty
```

but it will fail to find the desired package (which is distributed as `caption.dtx`) and does return unwanted 'hits' (such as `hangcaption.sty`). Also, although this example does not show it the '.' in 'caption.sty' is used as the regular expression that matches *any* character. So

```
quote site index doc.sty
```

matches such unwanted files as `language/swedish/slatex/doc2sty/makefile`

Of course if you *know* the package is stored as `.dtx` you can search for that name, but in general you may not know the extension used on the archive. The solution is to add '/' to the front of the package name and '\\.' to the end. This will then search for a file name that consists solely of the package name between the directory separator and the extension. The two commands:

```
quote site index /caption\\.
```

```
quote site index /doc\\.
```

do narrow the search down sufficiently. (In the case of `doc`, a few extra files are found, but the list returned is sufficiently small to be easily inspected.)

If the search string is too wide and too many files would match, the list will be truncated to the first 20 items found. Using some knowledge of the CTAN directory tree you can usually narrow the search sufficiently. As an example suppose you wanted to find a copy of the `dvips` driver for MS-DOS. You might use the command:

```
quote site index dvips
```

but the result would be a truncated list, not including the file you want. (If this list were not truncated 412 items would be returned!) However we can restrict the search to MS-DOS related drivers as follows.


```
quote site index msdos.*dvips
```

Which just returns relevant lines such as `systems/msdos/dviware/dvips/dvips5528.zip`

A basic introduction to searching with regular expressions is:

- Most characters match themselves, so "a" matches "a" etc.;
- "." matches any character;
- "[abcD-F]" matches any single character from the set {"a","b","c","D","E","F"};
- "*" placed after an expression matches zero or more occurrences so "a*" matches "a" and "aaaa", and "[a-zA-Z]*" matches a 'word';
- "\" 'quotes' a special character such as "." so "\" just matches ".";
- "^" matches the beginning of a line;
- "\$" matches the end of a line.

For technical reasons in the `quote site index` command, you need to 'double' any `\` hence the string `/caption\\` in the above example. The `quote site` command ignores the case of letters. Searching for `caption` or `CAPTION` would produce the same result.

50 Finding files by Web search

Two of the CTAN web servers offer a search facility: <http://www.tex.ac.uk/search> and <http://www.ctan.org/search>; you can look for a file whose name you already know (in pretty much the same way as the `ftp`-based `quote site index` command — see question 49), or you can do a keyword-based search of the catalogue.

The search script produces URLs for files that match your search criteria. The URLs point to the CTAN site or mirror of your choice; when you first use the script, it asks you to choose a site, and stores its details in a cookie on your machine. Choose a site that is close to you, to reduce network load.

51 Finding new fonts

A comprehensive list of METAFONT fonts used to be posted to `comp.fonts` and to `comp.text.tex`, roughly every six weeks, by Lee Quin.

Nowadays, authors of new material in METAFONT are few and far between (and mostly designing highly specialised things with limited appeal to ordinary users). Most new fonts that appear are prepared in some scalable outline form or other (see question 86), and they are almost all distributed under commercial terms.

METAFONT font list: info/metafont-list

52 T_EX CD-ROMs

If you don't have access to the Internet, there are obvious attractions to T_EX collections on a CD-ROM. Even those with net access will find large quantities of T_EX-related files to hand a great convenience.

Ready-to-run T_EX systems on CD-ROM are available:

- A consortium of User Groups (notably TUG, UK TUG and GUTenberg) distributes the T_EX Live CD-ROM, now in its sixth edition. All members of several User Groups receive copies free of charge. Some user groups will also sell additional copies:

contact your local user group or TUG (see question 21).

Details of T_EX Live are available from its own web page on the TUG site <http://www.tug.org/texlive.html>

- The Dutch T_EX Users Group (NTG) publish the whole 4AllT_EX workbench on a 2-CD-ROM set packed with all the Windows T_EX software, macros and fonts you can want. It is available from NTG (see <http://www.ntg.nl/>) direct, from TUG for \$40 and from UK TUG for £30 (a manual is included). It is a useful resource for anyone to browse, not just for Windows users.

An alternative to the ready-to-run system is the CTAN archive snapshot; in general one would expect that such systems would be harder to use, but that the volume of resources offered would balance this extra inconvenience. There were once commercial offerings in this field, but nowadays the snapshot supplied to user group members annually is about the only source of such things.

F T_EX Systems

53 (L)T_EX for different machines

We list here the free or shareware packages; see question 55 for details of commercial packages.

Unix Instructions for retrieving the *web2c* Unix T_EX distribution via anonymous `ftp` are to be found in `unixtex.ftp`, though nowadays the sensible installer will take (and possibly customise) one of the packaged distributions such as `teTEX` (which often has a more recent version of *web2c* embedded than has been released "in the wild"), or the T_EX Live CD-ROM (see question 52).

For `teTEX`, you need at most one each of the `.tar.gz` files for `teTeX-src`, `teTeX-texmf` and `teTeX-texmfsrc`

Sets of binaries for many common Unix systems are to be found as part of the `teTEX` distribution, or on the T_EX Live CD-ROM. There are rather more to be found on CTAN; you'll find compressed `.tar` archive for each supported architecture in the directory. In default of a precompiled version, `teTEX` will compile on most Unix systems, though it was originally developed for use under Linux (see below).

MacOS X users should refer to the information below, under item "Mac".

tetex: Browse `systems/unix/teTeX/1.0/distrib/sources`

tetex binaries: Browse `systems/unix/teTeX/1.0/distrib/binaries`

unixtex.ftp: `systems/unix/unixtex.ftp`

web2c: `systems/web2c`

Linux There are at least two respectable implementations of T_EX to run on Linux, N_T_EX and `teTEX` (see above).

Beware the Slackware '96 CD-ROM distribution of N_T_EX: it includes a version of the CM fonts that

has deeply offended Don Knuth (since it contravenes his distribution conditions). The Slackware updates now offer teTeX , as do most Linux distributions. The most recent offering is a free version of the commercial VTeX (see question 55), which specialises in direct production of PDF from (\LaTeX) input.

ntex: systems/unix/ntex

tetex: Browse systems/unix/teTeX/1.0/distrib/sources

tetex binaries: Browse systems/unix/teTeX/1.0/distrib/binaries

vtex: systems/vtex/linux (needs systems/vtex/common)

PC; MS-DOS or OS/2 EmTeX , by Eberhard Mattes, includes \LaTeX , BIBTeX , previewers, and drivers, and is available as a series of zip archives. Documentation is available in both German and English. Appropriate memory managers for using emTeX with 386 (and better) processors and under Windows, are included in the distribution. EmTeX will operate under Windows, but Windows users are better advised to use a distribution tailored for the Windows environment.

A version of emTeX , packaged to use a TDS directory structure (see question 43), is separately available as an emTeX ‘contribution’.

emtex: systems/msdos/emtex

emtexTDS: systems/os2/emtex-contrib/emtexTDS

PC; MS-DOS The most recent offering is an MS-DOS port of the Web2C 7.0 implementation, using the GNU *djgpp* compiler.

djgpp: systems/msdos/djgpp

PC; OS/2 OS/2 may also use a free version of the commercial VTeX (see question 55), which specialises in direct production of PDF from (\LaTeX) input.

vtex: systems/vtex/linux (needs systems/vtex/common)

PC; Win32 fpTeX , by Fabrice Popineau, is a version of teTeX for Windows systems. As such, it is particularly attractive to those who need to switch back and forth between Windows and Unix environments, and to administrators who need to maintain both (fpTeX can use the same texmf tree as a teTeX installation). fpTeX ’s previewer (*Windvi*) is based on *xdvi*, and takes advantage of extra facilities in the Win32 environment. *Windvi* is capable of printing directly, and a version of *dvips* is also available.

MikTeX , by Christian Schenk, is also a comprehensive distribution, developed separately from the teTeX work. It has its own previewer, YAP, which is itself capable of printing, though the distribution also includes a port of *dvips*. The current version is available for file-by-file download (the HTML files in the directory offer hints on what you need to get going). A prepackaged version of the whole directory

is also available.

A further (free) option arises from the ‘CygWin’ bundle (see <http://www.cygwin.com>), which presents a Unix-like environment over the Win32 interface; an X-windows server is available. If you run CygWin on your Windows machine, you have the option of using teTeX , too (you will need the X-server, to run *xdvi*). Of course, teTeX components will look like Unix applications (but that’s presumably what you wanted), but it’s also reputedly somewhat slower than native Win32 implementations such as MikTeX or fpTeX . TeX is available as part of the CygWin distribution (in the same way that a version is available with most Linux distributions, nowadays), and you may also build your own copy from the current sources.

BaKoMa TeX , by Basil Malyshev, is a comprehensive (shareware) distribution, which focuses on support of Acrobat. The distribution comes with a bunch of Type 1 fonts packaged to work with BaKoMa TeX , which further the focus.

bakoma: nonfree/systems/win32/bakoma

fpTeX: systems/win32/fpTeX

mikTeX: Acquire systems/win32/mikTeX/setup/setup.exe and read systems/win32/mikTeX/setup/install.html

tetex: systems/unix/teTeX/1.0/distrib/sources

Windows NT, other platforms Ports of MikTeX for NT on Power PC and AXP are available. Neither version has been updated for version 1.2 (or later) of MikTeX — they may not be satisfactory.

mikTeX for AXP: systems/win32/mikTeX-AXP

mikTeX for Power PC: systems/win32/mikTeXppc

Mac OzTeX , by Andrew Trevorrow, is a shareware version of TeX for the Macintosh. A DVI previewer and PostScript driver are also included.

UK TUG prepays the shareware fee, so that its members may acquire the software without further payment. Questions about OzTeX may be directed to oztex@midway.uchicago.edu

Another partly shareware program is CMacTeX , put together by Tom Kiffe. This is much closer to the Unix TeX setup (it uses *dvips*, for instance). CMacTeX includes a port of the latest version of Omega (see question 236).

Both OzTeX and CMacTeX are additionally available on MacOS X (see <http://www.esm.psu.edu/mac-tex/versionsX.html>), but OS X users also have the option of TeX Live with a limited texmf tree based on teTeX by Gerben Wierda (see <http://www.ntg.nl/macosx-tex/tex.html>) This is naturally usable from the command line, just like any other Unix-based system, but it can also be used Mac-style as the engine behind Richard Koch’s (free) TeXShop , which is an integrated TeX editor and previewer.

A useful resource for Mac users is to be found at

<http://www.esm.psu.edu/mac-tex/>; it has a news and 'help' section, as well as details of systems and tools. A useful resource for Mac users (see <http://www.esm.psu.edu/mac-tex/>) has a news and 'help' section, as well as details of systems and tools.

cmactex: systems/mac/cmactex

oztex: nonfree/systems/mac/oztex

MacOS X TeX backend:

<http://www.ntg.nl/macosex-tex/ii-home/tex.html>

TeXShop frontend: <http://darkwing.uoregon.edu/~koch/texshop/texshop.html>

OpenVMS TeX for OpenVMS is available.

Standard tape distribution is through DECUS (see question 45).

OpenVMS: systems/OpenVMS/TEX97_CTAN.ZIP

Atari TeX is available for the Atari ST.

If anonymous ftp is not available to you, send a message containing the line 'help' to atari@atari.archive.umich.edu

Atari TeX: systems/atari

Amiga Full implementations of TeX 3.1 (PasTeX) and METAFONT 2.7 are available.

You can also order a CD-ROM containing this and other Amiga software from Walnut Creek CDROM, telephone +1 510-947-5997.

PasTeX: systems/amiga

TOPS-20 TeX was originally written on a DEC-10 under WAITS, and so was easily ported to TOPS-20. A distribution that runs on TOPS-20 is available via anonymous ftp from <ftp.math.utah.edu> in <pub/tex/pub/web>

54 TeX-friendly editors and shells

There are good TeX-writing environments and editors for most operating systems; some are described below, but this is only a personal selection:

Unix Try GNU *emacs* or *xemacs*, and the AUC-TeX mode (AUC-TeX is available from CTAN, but *emacs* itself isn't). AUC-TeX provides menu items and control sequences for common constructs, checks syntax, lays out markup nicely, lets you call TeX and drivers from within the editor, and everything else like this that you can think of. Complex, but very powerful.

Nedit (see <http://nedit.org/>) is another free, programmable, editor available for Unix systems. An AUC-TeX-alike package for *Nedit* is available from CTAN.

MS-DOS There are several choices:

- TeXshell is a simple, easily-customisable environment, which can be used with the editor of your choice.
- Eddi4TeX (also shareware) is a specially-written TeX editor which features intelligent colouring, bracket matching, syntax checking,

online help and the ability to call TeX programs from within the editor. It is highly customisable, and features a powerful macro language.

You can also use GNU *emacs* and AUC-TeX under MS-DOS.

Windows '9x, NT, etc. *Winedt*, a shareware package, is highly spoken of. It provides a shell for the use of TeX and related programs, as well as a powerful and well-configured editor.

The 4AllTeX CD-ROM (see question 52) contains another powerful Windows-based shell.

OS/2 Eddi4TeX works under OS/2; an alternative is *epmtex*, which offers an OS/2-specific shell.

Macintosh The commercial Textures provides an excellent integrated Macintosh environment with its own editor. More powerful still (as an editor) is the shareware *Alpha* which is extensible enough to let you perform almost any TeX-related job. It works well with OzTeX.

Atari, Amiga and NeXT users also have nice environments. LaTeX users looking for *make*-like facilities should try *latexmk*.

There is another set of shell programs to help you manipulate BIBTeX databases.

alpha: systems/mac/support/alpha

auctex: support/auctex

epmtex: systems/os2/epmtex

latexmk: support/latexmk

nedit latex support: support/NEdit-LaTeX-Extensions

TeXshell: systems/msdos/texshell

TeXtelmExtel: systems/msdos/emtex-contrib/TeXtelmExtel

winedt: systems/win32/winedt/winedt32.exe

55 Commercial TeX implementations

There are many commercial implementations of TeX. The first appeared not long after TeX itself appeared.

What follows is probably an incomplete list. Naturally, no warranty or fitness for purpose is implied by the inclusion of any vendor in this list. The source of the information is given to provide some clues to its currency.

In general, a commercial implementation will come 'complete', that is, with suitable previewers and printer drivers. They normally also have extensive documentation (*i.e.*, not just the TeXbook!) and some sort of support service. In some cases this is a toll free number (probably applicable only within the USA and or Canada), but others also have email, and normal telephone and fax support.

PC; TrueTeX Runs on all versions of Windows.

Richard J. Kinch
TrueTeX Software
6994 Pebble Beach Court
Lake Worth FL 33467
USA

Tel: +1 561-966-8400
Email: kinch@truetex.com
Web: <http://www.truetex.com/>

Source: Mail from Richard Kinch, October 2001.

PC; Y&Y T_EX “Bitmap free T_EX for Windows.”

Y&Y, Inc.
106 Indian Hill, MA 01741
USA
Tel: 800-742-4059 (within North America)
Tel: +1 978-371-3286
Fax: +1 978-371-2004
Email: sales-help@YandY.com and
tech-help@YandY.com
Web: <http://www.YandY.com/>

Source: Mail from Y&Y, July 2001

pcT_EX Long-established: pcT_EX32 is a Windows implementation.

Personal T_EX Inc
12 Madrona Street
Mill Valley, CA 94941
USA
Tel: 800-808-7906 (within the USA)
Fax: +1 415-388-8865
Email: texsales@pctex.com and
texsupp@pctex.com
Web: <http://www.pctex.com/>

Source: Mail from Personal T_EX Inc, September 1997

PC; VT_EX DVI, PDF and HTML backends, Visual Tools and Type 1 fonts

MicroPress Inc
68-30 Harrow Street
Forest Hills, NY 11375
USA
Tel: +1 718-575-1816
Fax: +1 718-575-8038
Email: support@micropress-inc.com
Web: <http://www.micropress-inc.com/>

Source: Mail from MicroPress, Inc., July 1999

PC; Scientific Word Scientific Word and Scientific Workplace offer a mechanism for near-WYSIWYG input of L^AT_EX documents; they ship with TrueT_EX from Kinch (see above). Queries within the UK and Ireland should be addressed to Scientific Word Ltd., others should be addressed directly to the publisher, MacKichan Software Inc.

Dr Christopher Mabb
Scientific Word Ltd.
49 Queen Street
Peterhead
Aberdeenshire, AB42 1TU
UK
Tel: 0845 766 0340 (within the UK)
Tel: +44 1779 490500
Fax: 01779 490600 (within the UK)
Email: christopher@sciword.demon.co.uk

co.uk
Web: <http://www.sciword.demon.co.uk>

MacKichan Software Inc.
600 Ericksen Ave. NE, Suite 300
Bainbridge Island WA 98110
USA

Tel: +1 206 780 2799
Fax: +1 206 780 2857
Email: info@mackichan.com
Web: <http://www.mackichan.com>

Source: Mail from Christopher Mabb, May 1999

Macintosh; Textures “A T_EX system ‘for the rest of us’”; also gives away a METAFONT implementation and some font manipulation tools.

Blue Sky Research
534 SW Third Avenue
Portland, OR 97204
USA
Tel: 800-622-8398 (within the USA)
Tel: +1 503-222-9571
Fax: +1 503-222-1643
Email: sales@bluesky.com
Web: <http://www.bluesky.com/>

Source: TUGboat 15(1) (1994)

AmigaT_EX A full implementation for the Commodore Amiga, including full, on-screen and printing support for all PostScript graphics and fonts, IFF raster graphics, automatic font generation, and all of the standard macros and utilities.

Radical Eye Software
PO Box 2081
Stanford, CA 94309
USA

Source: Mail from Tom Rokicki, November 1994

G DVI Drivers and Previewers

56 DVI to PostScript conversion programs

The best public domain DVI to PostScript conversion program, which runs under many operating systems, is Tom Rokicki’s *dvips*. *dvips* is written in C and ports easily. All current development is in the context of Karl Berry’s *kpathsea* library, and sources are available from the T_EX live repository.

VMS versions are available through the DECUS library (see question 45), and also as part of the CTAN distribution of T_EX for VMS.

A precompiled version to work with emT_EX is available on CTAN.

Macintosh users can use either the excellent drivers built into OzT_EX or Textures, or a port of *dvips* in the CMacT_EX package.

MS-DOS and OS/2: [systems/msdos/dviware/dvips](#)

VMS distribution: [systems/OpenVMS/TEX97_CTAN.ZIP](#)

57 DVI drivers for HP LaserJet

The emTeX distribution (see question 53) contains a driver for the LaserJet, *dvihplj*.

Version 2.10 of the Beebe drivers supports the LaserJet. These drivers will compile under Unix, VMS, and on the Atari ST and DEC-20s.

For Unix systems, Karl Berry's *dviljk* uses the same path-searching library as *web2c*.

Beebe drivers: dviware/beebe

dviljk: dviware/dviljk

58 Output to "other" printers

In the early years of TeX, there were masses of DVI drivers for any (then) imaginable kind of printer, but the steam seems rather to have gone out of the market for production of such drivers for printer-specific formats. There are several reasons for this, but the primary one is that few formats offer the flexibility available through PostScript, and *ghostscript* is so good, and has such a wide range of printer drivers (perhaps this is where the DVI output driver writers have all gone?).

The general advice, then, is to generate PostScript (see question 56), and to process that with *ghostscript* set to generate the format for the printer you actually have. If you are using a Unix system of some sort, it's generally quite easy to insert *ghostscript* into the print spooling process.

ghostscript: Browse nonfree/support/ghostscript

59 DVI previewers

EmTeX for PCs running MS-DOS or OS/2, MikTeX and fpTeX for PCs running Windows and OzTeX for the Macintosh, all come with previewers that can be used on those platforms. EmTeX's previewer can also be run under Windows 3.1.

Commercial PC TeX packages (see question 55) have good previewers for PCs running Windows, or for Macintoshes.

For Unix systems, there is one 'canonical' viewer, *xdvi*. *Xdvi* is a version of *xdvi* using the *web2c* libraries. Unix TeX distributions (such as teTeX or NTeX) include a version of *xdvik* using the same version of *web2c* as the rest of the distribution.

Alternatives to previewing include

- conversion to 'similar' ASCII text (see question 67) and using a conventional text viewer to look at that,
- generating a PostScript version of your document and viewing it with a *Ghostscript*-based previewer (see question 83), and
- generating PDF output, and viewing that with *Acrobat Reader* or one of the substitutes for that.

xdvi: dviware/xdvi

xdvik: dviware/xdvik

H Support Packages for TeX

60 Fig, a TeX-friendly drawing package

(X)Fig is a menu driven tool that allows you to draw objects on the screen of an X workstation; *transfig* is a

set of tools which translate the code *fig* produces to other graphics languages including PostScript and the LaTeX `picture` environment.

Fig is supported by Micah Beck and *transfig* is maintained by Brian Smith. Another tool for *fig* conversion is *fig2mf* which generates METAFONT code from *fig* input.

fig2mf: graphics/fig2mf

xfig: graphics/xfig

transfig: graphics/transfig

61 TeXCAD, a drawing package for LaTeX

TeXCAD is a program for the PC which enables the user to draw diagrams on screen using a mouse or arrow keys, with an on-screen menu of available picture-elements. Its output is code for the LaTeX `picture` environment. Optionally, it can be set to include lines at all angles using the emTeX driver-family `\specials` (see question 38). TeXCAD is part of the emTeX distribution.

A Unix port of the program (*xtexcad*) has been made.

emtex: systems/msdos/emtex

xtexcad: nonfree/graphics/xtexcad/xtexcad-2.4.1.tar.gz

62 Spelling checkers for work with TeX

For Unix, *ispell* is probably the program of choice; it is well integrated with the *emacs*, and deals with some TeX syntax.

For Windows, there is a good spell checker incorporated into the WinEDT and 4AllTeX shell/editors (see question 54). The 4AllTeX checker is also available as a separate package, *4spell*.

For the Macintosh, *Excalibur* is the program of choice. It will run in native mode on both sorts of Macintosh. The distribution comes with dictionaries for several languages.

The VMS Pascal program *spell* makes special cases of some important features of LaTeX syntax.

For MS-DOS, there are several programs. *Amspell* can be called from within an editor, and *jspell* is an extended version of *ispell*.

4spell: support/4spell

amspell: support/amspell

excalibur: systems/mac/support/excalibur/Excalibur-3.0.2.hqx

ispell: Browse support/ispell, but beware of any version with a number 4.x — such versions represent a divergent version of the source which lacks many useful facilities of the 3.x series.

jspell: support/jspell

VMS *spell*: support/vmspell

winedt: systems/win32/winedt/winedt32.exe

63 How many words have you written?

One often has to submit a document (e.g., a paper or a dissertation) under some sort of constraint about its size. Sensible people set a constraint in terms of numbers of pages, but there are some that persist in limiting the numbers of words you type.

A simple solution to the requirement can be achieved following a simple observation: the powers that be are unlikely to count all the words of a document submitted to them. Therefore, a statistical method can be employed: find how many words there are on a full page; find how many full pages there are in the document (allowing for displays of various sorts, this number will probably not be an integer); multiply the two. However, if the document to be submitted is to determine the success of the rest of one's life, it takes a brave person to thumb their nose at authority quite so comprehensively. . .

The simplest method is to strip out the \LaTeX markup, and to count what's left. On a Unix-like system, this may be done using *detex* and the built-in *wc*:

```
detex <filename> | wc -w
```

Winedt (see question 54) in the Windows environment provides this functionality direct.

Simply stripping \LaTeX markup isn't entirely reliable, however: that markup itself may contribute typeset words, and this could be a problem. The *wordcount* package contains a Bourne shell (i.e., typically Unix) script for running a \LaTeX file with a special piece of supporting \TeX code, and then counting word indications in the log file. This is probably as accurate automatic counting as you can get.

```
detex: support/detex
```

```
wordcount: macros/latex/contrib/supported/  
wordcount
```

I Literate programming

64 What is Literate Programming?

Literate programming is the combination of documentation and source together in a fashion suited for reading by human beings. In general, literate programs combine source and documentation in a single file. Literate programming tools then parse the file to produce either readable documentation or compilable source. The WEB style of literate programming was created by D. E. Knuth during the development of \TeX .

The “documented \LaTeX ” style of programming (see question 39) is regarded by some as a form of literate programming, though it only contains a subset of the constructs Knuth used.

Discussion of literate programming is conducted in the newsgroup `comp.programming.literate`, whose FAQ is stored on CTAN. Another good source of information is <http://www.literateprogramming.com/>

Literate Programming FAQ: `help/LitProg-FAQ`

65 WEB systems for various languages

\TeX is written in the programming language WEB; WEB is a tool to implement the concept of “literate program-

ming”. Knuth's original implementation will be in any respectable distribution of \TeX , but the sources of the two tools (*tangle* and *weave*), together with a manual outlining the programming techniques, may be had from CTAN.

CWEB, by Silvio Levy, is a WEB for C programs.

Spidery WEB, by Norman Ramsey, supports many languages including Ada, `awk`, and C and, while not in the public domain, is usable without charge.

FWEB, by John Krommes, is a version for Fortran, Ratfor, and C.

SchemeWEB, by John Ramsdell, is a Unix filter that translates SchemeWEB into \LaTeX source or Scheme source.

APLWEB is a version of WEB for APL.

FunnelWeb is a version of WEB that is language independent.

Other language independent versions of WEB are *nuweb* (which is written in ANSI C) and *noweb*.

Tweb is a WEB for Plain \TeX macro files, using *noweb*.

```
aplweb: web/apl/aplweb
```

```
cweb: web/c_cpp/cweb
```

```
funnelweb: web/funnelweb
```

```
fweb: web/fweb
```

```
noweb: web/noweb
```

```
nuweb: web/nuweb
```

```
schemeweb: web/schemeweb
```

```
spiderweb: web/spiderweb
```

```
tangle: systems/knuth/web
```

```
tweb: web/tweb
```

```
weave: systems/knuth/web
```

J Format conversions

66 Conversion between \LaTeX and others

troff *troff-to-latex*, written by Kamal Al-Yahya at Stanford University (California, USA), assists in the translation of a *troff* document into \LaTeX format. It recognises most `-ms` and `-man` macros, plus most *eqn* and some *tbl* preprocessor commands. Anything fancier needs to be done by hand. Two style files are provided. There is also a man page (which converts very well to \LaTeX ...). The program is copyrighted but free. *tr2latex* is an enhanced version of this *troff-to-latex*.

The DECUS \TeX distribution (see question 45) also contains a program which converts *troff* to \TeX .

WordPerfect *wp2latex* has recently been much improved, and is now available either for MS-DOS or for Unix systems, thanks to its current maintainer Jaroslav Fojtik.

PC-Write *pcwritex.arc* is a print driver for PC-Write that “prints” a PC-Write V2.71 document to a \TeX -compatible disk file. It was written by Peter Flynn at University College, Cork, Republic of Ireland.

runoff Peter Vanroose's *rnototex* conversion program is written in VMS Pascal. The sources are distributed with a VAX executable.

refer/tib There are a few programs for converting bibliographic data between BIB_TE_X and *refer/tib* formats. The collection includes a shell script converter from BIB_TE_X to *refer* format as well. The collection is not maintained.

RTF *Rtf2tex*, by Robert Lupton, is for converting Microsoft's Rich Text Format to T_EX. There is also a converter to L^AT_EX by Erwin Wechtl, called *rtf2latex*. The latest converter, by Ujwal Sathyam and Scott Pahl, is *rtf2latex2e*; this system seems rather good already, and is still being improved. Translation to RTF may be done (for a somewhat constrained set of L^AT_EX documents) by T_EX2RTF, which can produce ordinary RTF, Windows Help RTF (as well as HTML, see question 69). T_EX2RTF is supported on various Unix platforms and under Windows 3.1

Microsoft Word A rudimentary program for converting MS-Word to L^AT_EX is *wd2latex*, for MS-DOS; a better idea, however, is to convert the document to RTF format and use one of the RTF converters mentioned above.

Excel *Excel2Latex* converts an *Excel* file into a L^AT_EX `tabular` environment; it comes as a `.xls` file which defines some *Excel* macros to produce output in a new format.

A separate FAQ by Wilfried Hennings deals specifically with conversions between T_EX-based formats and word processor formats may be referred to for more detailed information.

A group at Ohio State University (USA) is working on a common document format based on SGML, with the ambition that any format could be translated to or from this one. *FrameMaker* provides "import filters" to aid translation from alien formats (presumably including T_EX) to *FrameMaker*'s own.

excel2latex: support/excel2latex/xl2latex.zip

pcwritex.arc: support/pcwritex

refer and tib tools: biblio/bibtex/utills/refer-tools

rnototex: support/rnototex

rtf2latex: support/rtf2latex

rtf2latex2e: support/rtf2latex2e

rtf2tex: support/rtf2tex

tex2rtf: support/tex2rtf

tr2latex: support/tr2latex

troff-to-latex: support/troff-to-latex

wd2latex: dviware/wd2latex

wp2latex: support/wp2latex

Word processor FAQ: <http://www.tug.org/utilities/texconv/index.html>

Word processor FAQ (source):
help/wp-conv/wp-conv.zip

67 Conversion from (L^A)T_EX to plain ASCII

The aim here is to emulate the Unix *nroff*, which formats text as best it can for the screen, from the same input as the Unix typesetting program *troff*.

Converting DVI to plain text is the basis of many of these techniques; sometimes the simple conversion provides a good enough response. Options are:

- *dvi2tty* (one of the earliest)
- *crudetype*
- *catdvi*, which is also capable of generating Latin-1 or UTF-8 encoded output. *Catdvi* was conceived as a replacement for *dvi2tty*, but can't (quite) be recommended as a complete replacement yet.

Ralph Droms provides a *txt* bundle of things in support of ASCII generation, but it doesn't do a good job with tables and mathematics. An alternative is the *screen* package.

Another possibility is to use the L^AT_EX-to-ASCII conversion program, *l2a*, although this is really more of a de-T_EXing program.

The canonical de-T_EXing program is *detex*, which removes all comments and control sequences from its input before writing it to its output. Its original purpose was to prepare input for a dumb spelling checker, and it's only usable for preparing useful ASCII versions of a document in highly restricted circumstances.

Tex2mail is slightly more than a de-TeXer — it's a Perl script that converts T_EX files into plain text files, expanding various mathematical symbols (sums, products, integrals, sub/superscripts, fractions, square roots, ...) into "ASCII art" that spreads over multiple lines if necessary. The result is more readable to human beings than the flat-style T_EX code.

Another significant possibility is to use one of the HTML-generation solutions (see question 69), and then to use a browser such as *lynx* to dump the resulting HTML as plain text.

catdvi: dviware/catdvi

crudetype: dviware/crudetype

detex: support/detex

dvi2tty: nonfree/dviware/dvi2tty

l2a: support/l2a

screen.sty: macros/latex209/contrib/misc/screen.sty

tex2mail: support/tex2mail

txt: support/txt

68 Conversion from SGML or HTML to T_EX

SGML is a very important system for document storage and interchange, but it has no formatting features; its companion ISO standard DSSSL (see <http://www.jclark.com/dsssl/>) is designed for writing transformations and formatting, but this has not yet been widely implemented. Some SGML authoring systems (e.g., *SoftQuad Author/Editor*) have formatting abilities, and there are high-end specialist SGML typesetting systems (e.g., Miles33's *Genera*). However, the majority of SGML users

probably transform the source to an existing typesetting system when they want to print. \TeX is a good candidate for this. There are three approaches to writing a translator:

1. Write a free-standing translator in the traditional way, with tools like *yacc* and *lex*; this is hard, in practice, because of the complexity of SGML.
2. Use a specialist language designed for SGML transformations; the best known are probably *Omnimark* and *Balise*. They are expensive, but powerful, incorporating SGML query and transformation abilities as well as simple translation.
3. Build a translator on top of an existing SGML parser. By far the best-known (and free!) parser is James Clark's *nsgmls*, and this produces a much simpler output format, called ESIS, which can be parsed quite straightforwardly (one also has the benefit of an SGML parse against the DTD). Two good public domain packages use this method:
 - David Megginson's *sgmlspm*, written in Perl 5, which is available from <http://www.perl.com/CPAN/modules/by-module/SGMLS>
 - Joachim Schrod and Christine Detig's *stil*, written in Common Lisp, which is available from <ftp://ftp.th-darmstadt.de/pub/text/sgml/stil>

Both of these allow the user to write 'handlers' for every SGML element, with plenty of access to attributes, entities, and information about the context within the document tree.

If these packages don't meet your needs for an average SGML typesetting job, you need the big commercial stuff.

Since HTML is simply an example of SGML, we do not need a specific system for HTML. However, Nathan Torkington developed *html2latex* from the HTML parser in NCSA's Xmosaic package. The program takes an HTML file and generates a \LaTeX file from it. The conversion code is subject to NCSA restrictions, but the whole source is available as <support/html2latex>

Michel Goossens and Janne Saarela published a very useful summary of SGML, and of public domain tools for writing and manipulating it, in *TUGboat* **16**(2).

69 (\LaTeX) \TeX conversion to HTML

\TeX and \LaTeX are well suited to producing electronically publishable documents. However, it is important to realize the difference between page layout and functional mark-up. \TeX is capable of extremely detailed page layout; HTML is not, because HTML is a functional mark-up language not a page layout language. HTML's exact rendering is not specified by the document that is published but is, to some degree, left to the discretion of the browser. If you require your readers to see an exact replication of what your document looks like to you, then you cannot use HTML and you must use some other publishing format such as PDF. That is true for any HTML authoring tool.

\TeX 's excellent mathematical capabilities remain a challenge in the business of conversion to HTML. There

are only two generally reliable techniques for generating mathematics on the web: creating bitmaps of bits of typesetting that can't be translated, and using symbols and table constructs. Neither technique is entirely satisfactory. Bitmaps lead to a profusion of tiny files, are slow to load, and are inaccessible to those with visual disabilities. The symbol fonts offer poor coverage of mathematics, and their use requires configuration of the browser. The future of mathematical browsing may be brighter — see question 239.

For today, possible packages are:

LaTeX2HTML a *perl* script package that supports \LaTeX only, and generates mathematics (and other "difficult" things) using bitmaps. The original version was written by Nikos Drakos for Unix systems, but the package is now also available for Windows systems. Michel Goossens and Janne Saarela published a detailed discussion of *LaTeX2HTML*, and how to tailor it, in *TUGboat* **16**(2).

TtH a compiled program that supports either \LaTeX or plain \TeX , and uses the font/table technique for representing mathematics. It is written by Ian Hutchinson, using *flex*. The distribution consists of a single C source (or a compiled executable), which is easy to install and very fast-running.

TeX4ht a compiled program that supports either \LaTeX or plain \TeX , by processing a DVI file; it uses bitmaps for mathematics, but can also use other technologies where appropriate. Written by Eitan Gurari, it parses the DVI file generated when you run (\LaTeX) over your file with *tex4ht*'s macros included. As a result, it's pretty robust against the macros you include in your document, and it's also pretty fast.

TeXpider a commercial program from MicroPress (see question 55), which is described on <http://www.micropress-inc.com/webb/wbstart.htm>; it uses bitmaps for equations.

Hevea a compiled program that supports \LaTeX only, and uses the font/table technique for equations (indeed its entire approach is very similar to *TtH*). It is written in Objective CAML by Luc Maranget. *Hevea* isn't archived on CTAN; details (including download points) are available via <http://pauillac.inria.fr/~maranget/hevea/>

The World Wide Web Consortium maintains a list of "filters" to HTML, with sections on (\LaTeX) and $\text{BIB}\TeX$ — see http://www.w3.org/Tools/Word_proc_filters.html

latex2html: <support/latex2html>

tex4ht: <support/TeX4ht/tex4ht.zip>

tth: nonfree/support/tth/dist/tth_C.tgz

70 Using \TeX to read SGML or XML directly

This can nowadays be done, with a certain amount of clever macro programming. David Carlisle's *xmltex* is the prime example; it offers a practical solution to typesetting XML files.

One use of a \TeX that can typeset XML files is as a backend processor for XSL formatting objects, serialized

as XML. Sebastian Rahtz's PassiveTeX uses *xmltex* to achieve this end.

xmltex: macros/xmltex/base

passivetex: macros/xmltex/contrib/passivetex

71 Retrieving (L^A)TeX from DVI, etc.

The job just can't be done automatically: DVI, PostScript and PDF are "final" formats, supposedly not susceptible to further editing — information about where things came from has been discarded. So if you've lost your (L^A)TeX source (or never had the source of a document you need to work on) you've a serious job on your hands. In many circumstances, the best strategy is to retype the whole document, but this strategy is to be tempered by consideration of the size of the document and the potential typists' skills.

If automatic assistance is necessary, it's unlikely that any more than text retrieval is going to be possible; the (L^A)TeX markup that creates the typographic effects of the document needs to be recreated by editing.

If the file you have is in DVI format, many of the techniques for converting (L^A)TeX to ASCII (see question 67) are applicable. Consider *dvi2tty*, *crudetype* and *catdvi*. Remember that there are likely to be problems finding included material (such as included PostScript figures, that don't appear in the DVI file itself), and mathematics is unlikely to convert easily.

To retrieve text from PostScript files, the *ps2ascii* tool (part of the *ghostscript* distribution) is available. One could try applying this tool to PostScript derived from an PDF file using *pdf2ps* (also from the *ghostscript* distribution), or *Acrobat Reader* itself; an alternative is *pdftotext*, which is distributed with *xpdf*.

catdvi: dviware/catdvi

crudetype: dviware/crudetype

dvi2tty: nonfree/dviware/dvi2tty

ghostscript: nonfree/support/ghostscript

xpdf: Browse support/xpdf

72 Translating L^ATeX to Plain TeX

Unfortunately, no "general", simple, automatic process is likely to succeed at this task. See "How does L^ATeX relate to Plain TeX" (see question 11) for further details.

Translating a document designed to work with L^ATeX into one designed to work with Plain TeX is likely to amount to carefully including (or otherwise re-implementing) all those parts of L^ATeX, beyond the provisions of Plain TeX, which the document uses.

K Hypertext and PDF

73 Making hypertext documents from TeX

If you want on-line hypertext with a (L^A)TeX source, probably on the World Wide Web, there are four technologies to consider:

1. Direct (L^A)TeX conversion to HTML (see question 69);

2. Use *Texinfo* (see question 16), and use the *info* viewer, or convert the *texinfo* to HTML;
3. Use Adobe Acrobat, which will preserve your type-setting perfectly (see question 74);
4. The hyperTeX conventions (standardised `\special` commands); there are supporting macro packages for Plain TeX and L^ATeX).

The HyperTeX project extended the functionality of all the L^ATeX cross-referencing commands (including the table of contents) to produce `\special` commands which are parsed by DVI processors conforming to the HyperTeX guidelines; it provides general hypertext links, including those to external documents.

The HyperTeX specification says that conformant viewers/translators must recognize the following set of `\special` commands:

```
href: html:<a href = "href_string">
name: html:<a name = "name_string">
end: html:</a>
image: html:<img src = "href_string">
base_name: html:<base href = "href_string">
```

The *href*, *name* and *end* commands are used to do the basic hypertext operations of establishing links between sections of documents.

Further details are available on <http://arXiv.org/hypertext/>; there are two commonly-used implementations of the specification, a modified *xdvi* and (recent releases of) *dvips*. Output from the latter may be used in recent releases of *ghostscript* or Acrobat Distiller.

74 Making Acrobat documents from L^ATeX

There are three general routes to Acrobat output: Adobe's original 'distillation' route (via PostScript output), conversion of a DVI file, and the use of a direct PDF generator such PDFTeX (see question 238) or MicroPress's VTeX (see question 55).

For simple documents (with no hyper-references), you can either

- process the document in the normal way, produce PostScript output and distill it;
- (on a Windows or Macintosh machine with the appropriate Adobe tools installed) pass the output through the PDFwriter in place of a printer driver (this route is a dead end: the PDFwriter cannot create hyperlinks);
- process the document in the normal way and generate PDF direct from the DVI with *dvipdfm*; or
- process the document direct to PDF with PDFTeX or VTeX. PDFTeX has the advantage of availability for a wide range of platforms, VTeX (available commercially for Windows, or free of charge for Linux or OS/2) has wider graphics capability, dealing with encapsulated PostScript and some in-line PostScript.

To translate all the L^ATeX cross-referencing into Acrobat links, you need a L^ATeX package to suitably redefine the internal commands. There are two of these for L^ATeX, both capable of conforming to the HyperTeX specification (see question 73): Sebastian Rahtz's *hyperref*,

and Michael Mehlich's *hyper*. *Hyperref* uses a configuration file to determine how it will generate hypertext; it can operate using PDF \TeX primitives, the hyper \TeX `\specials`, or DVI driver-specific `\special` commands. Both *dvips* and Y&Y's *DVIPSONE* translate the DVI with these `\special` commands into PostScript acceptable to Distiller, and *dvipdfm* has `\special` commands of its own.

There is no free implementation of all of Adobe Distiller's functionality, but recent versions of *ghostscript* provide pretty reliable distillation (but beware of the problems discussed in question 75). Also, *Distiller* itself is now remarkably cheap (for academics at least).

For viewing (and printing) the resulting files, Adobe's *Acrobat Reader* is available for a fair range of platforms; for those for which Adobe's reader is unavailable, remotely current versions of *ghostscript* can display and print PDF files.

Acrobat Reader: browse ftp:

`//ftp.adobe.com/pub/adobe/acrobatreader`

dvipdfm: `dviware/dvipdfm`

ghostscript: Browse `nonfree/support/ghostscript`

hyper.sty: `macros/latex/contrib/supported/hyper`

hyperref.sty: `macros/latex/contrib/supported/hyperref`

vtex: `systems/vtex/linux` (for Linux) or `systems/vtex/os2` (for OS/2), together with `systems/vtex/common`

75 Quality of PDF from PostScript

Any output of *dvips* may (in principle) be converted to PDF, using either a sufficiently recent version of *ghostscript* or Adobe's (commercial) *Distiller*, but the results can be pretty poor if certain simple precautions are omitted.

First, it's important to use type 1 fonts in preparing the output; METAFONT bitmap fonts get converted to type 3 fonts when converting to PDF, and Adobe's *Acrobat Reader* (which most of the world uses to view PDF files) makes a very poor fist of displaying type 3 fonts. If you've written a document that uses nothing but fonts such as Adobe Times, which only exist in type 1 format, no further action is actually required; however, most ordinary (A) \TeX documents contain at least odd characters that originate in METAFONT, and it's advisable to tell *dvips* to use type 1 versions regardless. One does this by using the *dvips* switches `-Pcmz` and `-Pamz`.

Second, if you're using *ghostscript* (or the *ps2pdf* script that's distributed with it) make sure you have an appropriate version. Again, if your document contains nothing but the "basic PostScript" set of fonts (Times, etc), the restrictions are less burdensome and you can get away with using *ghostscript* version 5.50; however, that version makes type 3 fonts of any type 1 fonts embedded in the PostScript, which is pretty unsatisfactory. To be safe, ensure that you're using *ghostscript* version 6.00 at least (at the time of writing, version 7.04 is current).

Third, some versions of *Acrobat Reader* are confused by characters that are in positions where Adobe fonts don't hold characters, and most METAFONT-supplied

fonts have such characters (even after they've been converted to type 1). *Dvips* provides a means for remapping these characters to places where they'll be harmless; to invoke this facility, execute *dvips* with the switch `-G1`

Recent distributions of *dvips* come with a "pdf" pseudo-printer description file; this bundles selection of the type 1 fonts and character remapping with setting a very high nominal printer resolution, thus sidestepping *dvips*'s tendency to 'optimise' output destined for low-resolution printers. Use this by including the `-Ppdf` switch in your *dvips* command line.

76 Finding '8-bit' Type 1 fonts

Elsewhere, these FAQs recommend that you use an '8-bit' font to permit accentuation of inflected languages (see question 173), and also recommend the use of Type 1 fonts to ensure that you get good quality PDF (see question 75). Unfortunately, the combination proves not to be entirely straightforward: it's not always easy to find a satisfactory set of Type 1 fonts.

The recommendations prove to be contradictory: there are obstacles in the way of achieving both at the same time. You can use one of the myriad text fonts available in Type 1 format (with appropriate PSNFSS metrics for T1 encoding, or metrics for some other 8-bit encoding such as LY1); you can use a commercial or shareware CM-like Type 1 fonts; or you can use virtual font manipulations — but all these options have their drawbacks.

If you use someone else's text font (even something as simple as Adobe's Times family) you have to find a matching family of mathematical fonts, which is a non-trivial undertaking — see question 86.

Commercial CM-like fonts cost money: remarkably little money for commercial products with such a large intellectual property input, but more than this author could ordinarily expend... Y&Y offer their "European Modern" set: an extension of the CM fonts that may be used either with T1 or LY1 encoding; these are fonts from the same stable that gave us the free AMS/Blue Sky Research/Y&Y fonts, sensitively extended (though they don't cover the more eccentric areas of the T1 encoding, and don't come in the same welter of design sizes that the EC fonts offer). Micropress offer the complete EC set in Type 1 format, as part of their range of outline versions of fonts that were originally distributed in METAFONT format. See question 55.

The shareware BaKoMa \TeX distribution (see question 53) offers a set of Type 1 EC fonts, as an extra shareware option. (As far as the present author can tell, these fonts are *only* available to users of BaKoMa \TeX : they are stored in an archive format that seems not to be publicly available.)

Virtual fonts (see question 37) help us deal with the problem, since they allow us to map "bits of DVI file" to single characters in the virtual font; so we can create an "é" character by recreating the DVI commands that would result from the code `"\’e"`. However, since this involves two characters being selected from a font, the arrangement is sufficient to fool *Acrobat Reader*: you can't use the program's facilities for searching for text that contains inflected characters, and if you *cut* text from a window



that contains such a character, you'll find something unexpected (typically the accent and the 'base' characters separated by a space) when you *paste* the result. However, if you can live with this difficulty, virtual fonts are a useful, straightforward, and cheap solution to the problem.

There are two virtual-font offerings of CM-based 8-bit fonts — the *ae* ("almost EC") and *zefonts* sets; the *zefonts* set has wider coverage (though the *ae* set may be extended to offer guillemets by use of the *aeguill* package).

ae fonts: fonts/ae

aeguill.sty: macros/latex/contrib/supported/aeguill

zefonts: fonts/zefonts

77 Replacing Type 3 fonts in PostScript

One often comes across a PostScript file generated by *dvips* which contains embedded PK fonts; if you try to generate PDF from such a file, the quality will be poor.

Of course, the proper solution is to regenerate the PostScript file, but if neither the sources nor the DVI file are available, one must needs resort to some sort of patching to replace the bitmap fonts in the file by outline fonts.

The program *pkfix* (by Heiko Oberdiek) will do this patching, for files created by "not too old versions" of *dvips*: it finds the fonts to be replaced by examining the PostScript comments *dvips* has put in the file. For each font, *pkfix* puts appropriate T_EX commands in a file, which it then processes and runs through *dvips* (with switch `-Ppdf`) to acquire an appropriate copy of the font; these copies are then patched back into the original file.

Another program, *dvistrip*, is available from Y&Y's web site for Windows users who also have Adobe *Acrobat Distiller* available. *Dvistrip* simply removes the fonts: the idea is that you then reinstate them in the course of a run through *distiller* (which only works if *distiller* 'knows' about the fonts: it can be instructed via its Settings→Font Locations tool).

dvistrip: Download from <http://www.yandy.com/download/dvistrip.exe>

pkfix: support/pkfix

L METAFONT and MetaPost

78 Getting METAFONT to do what you want

METAFONT allows you to create your own fonts, and most T_EX users will never need to use it. METAFONT, unlike T_EX, requires some customisation: each output device for which you will be generating fonts needs a mode associated with it. Modes are defined using the `mode_def` convention described on page 94 of *The METAFONTbook* (see question 22). You will need a file, which conventionally called `local.mf`, containing all the `mode_defs` you will be using. If `local.mf` doesn't already exist, Karl Berry's collection of modes, available as `fonts/modes/modes.mf`, is a good starting point (it can be used as a 'local.mf'

without modification in a 'big enough' implementation of METAFONT). Lists of settings for various output devices are also published periodically in *TUGboat* (see question 21). Now create a plain base file using *inimf*, `plain.mf`, and `local.mf`:

```
% inimf
This is METAFONT...
**plain                you type 'plain'
(output)
*input local           you type this
(output)
*dump                  you type this
Beginning to dump on file plain...
(output)
```

This will create a base file named `plain.base` (or something similar; for example, it will be `PLAIN.BAS` on MS-DOS systems) which should be moved to the directory containing the base files on your system (note that some systems have two or more such directories, one for each 'size' of METAFONT used).

Now you need to make sure METAFONT loads this new base when it starts up. If METAFONT loads the `plain` base by default on your system, then you're ready to go. Under Unix (using the default *web2c* distribution⁵) this does indeed happen, but we could for instance define a command *mf* which executes `virmf &plain` loading the `plain` base file.

The usual way to create a font with `plain` METAFONT is to start it with the line

```
\mode=<mode name>; mag=<magnification>;
input <font file name>
```

in response to the `**` prompt or on the METAFONT command line. (If `<mode name>` is unknown or omitted, the mode defaults to 'proof' and METAFONT will produce an output file called `.2602gf`) The `<magnification>` is a floating point number or 'magstep' (magsteps are defined in *The METAFONTbook* and *The T_EXbook*). If `mag=<magnification>` is omitted, then the default is 1 (magstep 0). For example, to generate `cmr10` at 12pt for an Epson printer you would type

```
mf \mode=epson; mag=magstep 1; input cmr10
```

Note that under Unix the `\` and `;` characters must usually be quoted or escaped, so this would typically look something like

```
mf '\mode=epson; mag=magstep 1; input cmr10'
```

If you don't have *inimf* or need a special mode that isn't in the base, you can put its commands in a file (e.g., `ln03.mf`) and invoke it on the fly with the `\smode` command. For example, to create `cmr10.300gf` for an LN03 printer, using the file

⁵The `command_name` is symbolically linked to *virmf*, and *virmf* loads `command_name.base`

```
% This is ln03.mf as of 1990/02/27
% mode_def courtesy of John Sauter
proofing:=0;
fontmaking:=1;
tracingtitles:=0;
pixels_per_inch:=300;
blacker:=0.65;
fillin:=-0.1;
o_correction:=.5;
```

(note the absence of the `mode_def` and `enddef` commands), you would type

```
mf \smode="ln03"; input cmr10
```

This technique isn't one you should regularly use, but it may prove useful if you acquire a new printer and want to experiment with parameters, or for some other reason are regularly editing the parameters you're using. Once you've settled on an appropriate set of parameters, you should use them to rebuild the base file that you use.

A summary of the above written by Geoffrey Tobin, and tips about common pitfalls in using METAFONT, is available as `info/metafont-for-beginners.tex`

79 Which font files should be kept

METAFONT produces from its run three files, a metrics (TFM) file, a generic font (GF) file, and a log file; all of these files have the same base name as does the input (e.g., if the input file was `cmr10.mf`, the outputs will be `cmr10.tfm`, `cmr10.nnnmf`⁶ and `cmr10.log`).

For \TeX to use the font, you need a TFM file, so you need to keep that. However, you are likely to generate the same font at more than one magnification, and each time you do so you'll (incidentally) generate another TFM file; these files are all the same, so you only need to keep one of them.

To preview or to produce printed output, the DVI processor will need a font raster file; this is what the GF file provides. However, while there used (once upon a time) to be DVI processors that could use GF files, modern processors use packed raster (PK) files. Therefore, you need to generate a PK file from the GF file; the program *gftopk* does this for you, and once you've done that you may throw the GF file away.

The log file should never need to be used, unless there was some sort of problem in the METAFONT run, and need not be ordinarily kept.

80 Acquiring bitmap fonts

When CTAN was established, most people would start using \TeX with a 300 dots-per-inch (dpi) laser printer, and sets of Computer Modern bitmap fonts for this resolution are available on CTAN: `fonts/cm/pk/pk300.zip` (for write-black printer engines) and `fonts/cm/pk/pk300w.zip` (for write-white engines).

At that time, there were regular requests that CTAN should hold a wider range of resolutions, but they were resisted for two reasons:

1. When a bitmap font is created with METAFONT, it needs to know the characteristics of the device; who

knows what 600 or 1270 dpi device you have? (Of course, this objection applies equally well to 300 dpi printers.)

2. Bitmap fonts get *big* at high resolutions. Who knows what fonts at what sizes people are going to need?

Fortunately, (L^A) \TeX distribution technology has put a stop to these arguments: most (if not all) current distributions generate bitmap fonts as needed, and cache them for later re-use. The impatient user, who is determined that all bitmap fonts should be created once and for all, may be supported by scripts such as *allcm* (distributed with \TeX , at least; otherwise such a person should consult question 78).

If your output is to a PostScript-capable device, it may be worth switching to Type 1 versions of the CM fonts. Two free versions are currently available; the older (*bakoma*) is somewhat less well produced than the *bluesky* fonts, which were originally professionally produced and sold, but were then donated to the public domain by their originators Y&Y and Bluesky Research, in association with the AMS). Unfortunately, the coverage of the sets is slightly different, but the present author hasn't found the need to use *bakoma* since *bluesky* became available. In recent years, several other 'METAFONT' fonts have become available in Type 1 format; it's common never to find the need of generating bitmap fonts for any purpose other than previewing (see question 83).

The commercial font suppliers continue just to keep ahead of the free software movement, and provide Type 1 versions of the EC fonts, CM-style Cyrillic fonts, as well as a range of mathematical fonts to replace those in the CM family (see question 86).

bakoma: `fonts/cm/ps-type1/bakoma`

bluesky: `fonts/cm/ps-type1/bluesky`

81 Making MetaPost output display in *ghostscript*

MetaPost ordinarily expects its output to be included in some context where the 'standard' METAFONT fonts (that you've specified) are already defined — for example, as a figure in \TeX document. If you're debugging your MetaPost code, you may want to view it in *ghostscript* (or some other PostScript previewer). However, the PostScript 'engine' in *ghostscript* *doesn't* ordinarily have the fonts loaded, and you'll experience an error such as

```
Error: /undefined in cmmi10
```

There is provision in MetaPost for avoiding this problem: issue the command `prologues := 2;` at the start of the `.mp` file.

Unfortunately, the PostScript that MetaPost inserts in its output, following this command, is incompatible with ordinary use of the PostScript in inclusions into (L^A) \TeX documents, so it's best to make the `prologues` command optional. Furthermore, MetaPost takes a very simple-minded approach to font encoding: since \TeX font encodings regularly confuse sophisticated minds, this can prove troublesome. If you're suffering such problems (the

⁶Note that the file name may be transmuted by such operating systems as MS-DOS, which don't permit long file names

symptom is that characters disappear, or are wrongly presented) the only solution is to view the ‘original’ metapost output after processing through \LaTeX and *dvips*.

Conditional compilation may be done either by inputting `MyFigure.mp` indirectly from a simple wrapper `MyFigureDisplay.mp`:

```
prologues := 2;
input MyFigure
```

or by issuing a shell command such as

```
mp '\prologues:=2; input MyFigure'
```

(which will work without the quote marks if you’re not using a Unix shell).

A suitable \LaTeX route would involve processing `MyFigure.tex`, which contains:

```
\documentclass{article}
\usepackage{graphicx}
\begin{document}
\thispagestyle{empty}
\includegraphics{MyFigure.1}
\end{document}
```

Processing the resulting DVI file with the *dvips* command

```
dvips -E -o MyFigure.eps MyFigure
```

would then give a satisfactory Encapsulated PostScript file.

M PostScript and \TeX

82 Using PostScript fonts with \TeX

In order to use PostScript fonts, \TeX needs *metric* (called TFM) files. Several sets of metrics are available from the archives; for mechanisms for generating new ones, see question 84. You also need the fonts themselves; PostScript printers come with a set of fonts built in, but to extend your repertoire you almost invariably need to buy from one of the many commercial font vendors (see, for example, question 86).

If you use $\LaTeX 2_{\epsilon}$, the best way to get PostScript fonts into your document is to use the PSNFSS package maintained by Walter Schmidt; it’s supported by the $\LaTeX 3$ project team, so bug reports can and should be submitted. PSNFSS gives you a set of packages for changing the default roman, sans-serif and typewriter fonts; *e.g.*, `times.sty` will set up Times Roman, Helvetica and Courier in place of Computer Modern, while `avant.sty` just changes the sans-serif family to AvantGarde. To go with these packages, you will need the font metric files (watch out for encoding problems! — see question 84) and font description (`.fd`) files for each font family you want to use. Many sets of metrics, etc., can be obtained from the *psfonts* area of CTAN, arranged by vendor (*e.g.*, Adobe, Monotype, etc.). For convenience, metrics for the common ‘35’ PostScript fonts found in most printers are provided with PSNFSS, packaged as the “Laserwriter set”.

For older versions of \LaTeX there are various schemes, of which the simplest to use is probably the $\PS\LaTeX$ macros distributed with *dvips*.

For Plain \TeX , you load whatever fonts you like; if the encoding of the fonts is not the same as Computer Modern it will be up to you to redefine various macros and

accents, or you can use the font re-encoding mechanisms available in many drivers and in *ps2pk* and *afm2tfm*.

Victor Eijkhout’s Lollipop package (see question 15) supports declaration of font families and styles in a similar way to \LaTeX ’s NFSS, and so is easy to use with PostScript fonts.

Some common problems encountered are discussed elsewhere (see question 85).

Laserwriter set of 35 fonts:

```
macros/latex/required/psnfss/lw35nfss.zip
```

lollipop: macros/lollipop

psfonts: Browse fonts/psfonts

psnfss: macros/latex/required/psnfss

83 Previewing files using Type 1 fonts

Until recently, free \TeX previewers have only been capable of displaying bitmap PK fonts. (Y&Y’s commercial previewer DVIWindo (see question 55) has long used *Adobe Type Manager* to display Type 1 fonts directly, and the most recent releases of *xdvi* sport a Type 1 font renderer.) Other previewers of the current generation offer automatic generation of the requisite PK files (using *gsftopk*, or similar, behind the scenes). If your previewer isn’t capable of this, you have three options:

1. Convert the DVI file to PostScript and use a PostScript previewer. Some systems offer this capability as standard, but most people will need to use a separate previewer such as *ghostscript* or *ghostscript*-based viewers such as *ghostview* or shareware offering *gsview*.
2. Under Windows on a PC, or on a Macintosh, let Adobe Type Manager display the fonts. Textures (Macintosh) works like this, and under Windows you can use Y&Y’s *dviwindo* for bitmap-free previewing. (See question 55 for details of these suppliers.)
3. If you have the PostScript fonts in Type 1 format, use *ps2pk* or *gsftopk* (designed for use with the *ghostscript* fonts) to make PK bitmap fonts which your previewer will understand. This can produce excellent results, also suitable for printing with non-PostScript devices. Check the legalities of this if you have purchased the fonts. The very commonest PostScript fonts such as Times and Courier come in Type 1 format on disk with Adobe Type Manager (often bundled with Windows, and part of OS/2).

ghostscript: Browse nonfree/support/ghostscript

ghostview: Browse support/ghostscript/gnu/
ghostview

gsftopk: fonts/utilities/gsftopk

gsview: Browse nonfree/support/ghostscript/
gsview

ps2pk: fonts/utilities/ps2pk

xdvi: dviware/xdvi

84 T_EX font metric files for PostScript fonts

Reputable font vendors such as Adobe supply metric files for each font, in AFM (Adobe Font Metric) form; these can be converted to TFM (T_EX Font Metric) form. The CTAN archives have prebuilt metrics which will be more than enough for many people; but you may need to do the conversion yourself if you have special needs or acquire a new font. One important question is the *encoding* of (Latin character) fonts; while we all more or less agree about the position of about 96 characters in fonts (the basic ASCII set), the rest of the (typically) 256 vary. The most obvious problems are with floating accents and special characters such as the ‘pounds sterling’ sign. There are three ways of dealing with this: either you change the T_EX macros which reference the characters (not much fun, and error-prone); or you change the encoding of the font (easier than you might think); or you use virtual fonts (see question 37) to *pretend* to T_EX that the encoding is the same as it is used to. L^AT_EX 2_ε has facilities for dealing with fonts in different encodings; read the *L^AT_EX Companion* (see question 22) for more details. In practice, if you do much non-English (but Latin script) typesetting, you are strongly recommended to use the `fontenc` package with option ‘T1’ to select ‘Cork’ (see question 42) encoding. A useful alternative is Y&Y’s “private” LY1 encoding, which is designed to sit well with “Adobe standard” encoded fonts. Basic support of LY1 is available on CTAN: note that the “relation with Adobe’s encoding” means that there are no virtual fonts in the LY1 world.

Alan Jeffrey’s *fontinst* package is an AFM to TFM converter written in T_EX; it is used to generate the files used by L^AT_EX 2_ε’s PSNFSS package to support use of PostScript fonts. It is a sophisticated package, not for the faint-hearted, but is powerful enough to cope with most needs. Much of its power relies on the use of virtual fonts (see question 37).

For slightly simpler problems, Rokicki’s *afm2tfm*, distributed with *dvips*, is fast and efficient; note that the metrics and styles that come with *dvips* are *not* currently L^AT_EX 2_ε compatible.

For the Macintosh, there is a program called *EdMetrics* which does the job (and more). *EdMetrics* comes with the (commercial) Textures distribution, but is itself free software, and is available on CTAN.

Windows users can buy Y&Y’s (see question 55) Font Manipulation Tools package which includes a powerful *afmtotfm* program among many other goodies.

dvips: `dviware/dvips`

EdMetrics: `systems/mac/textures/utilities/EdMetrics.sea.hqx`

fontinst: `fonts/utilities/fontinst`

LY1 support: `macros/latex/contrib/supported/psnfssx/ly1`

PS font metrics: Browse `fonts/psfonts` (this directory is at the root of a really rather large tree), or <http://home.vr-web.de/was/fonts.html>, which contains metrics for “fonts that didn’t make it on to the CTAN directories”.

85 Deploying Type 1 fonts

For the L^AT_EX user trying to use the PSNFSS (see question 82) package, three questions may arise.

First, you have to declare to the DVI driver that you are using PostScript fonts; in the case of *dvips*, this means adding lines to the `psfonts.map` file, so that *dvips* will know where the proper fonts are, and won’t try to find PK files. If the font isn’t built into the printer, you have to acquire it (which may mean that you need to purchase the font files).

Second, your previewer must know what to do with the fonts: see question 83.

Third, the stretch and shrink between words is a function of the font metric; it is not specified in AFM files, so different converters choose different values. The PostScript metrics that come with PSNFSS used to produce quite tight setting, but they were revised in mid 1995 to produce a compromise between American and European practice. Really sophisticated users may not find even the new the values to their taste, and want to override them. Even the casual user may find more hyphenation or overfull boxes than CMR produces; but CMR is extremely generous.

86 Choice of scalable outline fonts

If you are interested in text alone, you can use any of over 20,000 fonts(!) in Adobe Type 1 format (called ‘PostScript fonts’ in the T_EX world and ‘ATM fonts’ in the DTP world), or any of several hundred fonts in TrueType format. That is, provided of course, that your previewer and printer driver support scalable outline fonts.

T_EX itself *only* cares about metrics, not the actual character programs. You just need to create a T_EX metric file TFM using some tool such as *afm2tfm* (possibly in combination with *vptouf*), *afmtotfm* (from Y&Y, see question 55) or *fontinst*. For the previewer or printer driver you need the actual outline font files themselves (`pfa` for Display PostScript, `pfb` for ATM on IBM PC, Mac outline font files on Macintosh).

If you also need mathematics, then you are severely limited by the demands that T_EX makes of maths fonts (for details, see the paper by B.K.P. Horn in *TUGboat* 14(3)). For maths, then, there are relatively few choices (though the list is at last growing). There are several font families available that are based on Knuth’s original designs, and some that complement other commercial text font designs; one set (MicroPress’s ‘informal math’) stands alone.

Computer Modern (75 fonts — optical scaling) Donald E. Knuth

The CM fonts were originally designed in METAFONT, but are also now available in scalable outline form. There are commercial as well as public domain versions, and there are both Adobe Type 1 and TrueType versions. A set of outline versions of the fonts was developed as a commercial venture by Y&Y and Blue Sky Research; they have since assigned the copyright to the AMS, and the fonts are now freely available from CTAN. Their quality is such that they have become the *de facto* standard for Type 1 versions of the fonts.

AMS fonts (52 fonts, optical scaling) The AMS

This set of fonts offers adjuncts to the CM set, including two sets of symbol fonts (`msam` and `msbm`) and Euler text fonts. These are not a self-standing family, but merit discussion here (not least because several other families mimic the symbol fonts). Freely-available Type 1 versions of the fonts are available on CTAN. The *eulervm* package permits use of the Euler maths alphabet in conjunction with text fonts that do not provide maths alphabets of their own (for instance, Adobe Palatino or Minion).

Computer Modern Bright (62 fonts — optical scaling) Walter Schmidt

CM Bright is a family of sans serif fonts, based on Knuth's CM fonts. It comprises the fonts necessary for mathematical typesetting, including AMS symbols, as well as text and text symbol fonts of various shapes. The collection comes with its own set of files for use with \LaTeX . The CM Bright fonts are supplied in Type 1 format by MicroPress, Inc.

For further details (including samples) see <http://www.micropress-inc.com/fonts/brmath/brmain.htm>

Concrete Math (25 fonts — optical scaling) Ulrik Vieth

The Concrete Math font set was derived from the Concrete Roman typefaces designed by Knuth. The set provides a collection of math italics, math symbol, and math extension fonts, and fonts of AMS symbols that fit with the Concrete set, so that Concrete may be used as a complete replacement for Computer Modern. Since Concrete is considerably darker than CM, the family may particularly attractive for use in low-resolution printing or in applications such as posters or transparencies. Concrete Math fonts, as well as Concrete Roman fonts, are supplied in Type 1 format by MicroPress, Inc.

For further information (including samples) see <http://www.micropress-inc.com/fonts/ccmath/ccmain.htm>

BA Math (13 fonts) MicroPress Inc.

BA Math is a family of serif fonts, inspired by the elegant and graphically perfect font design of John Baskerville. BA Math comprises the fonts necessary for mathematical typesetting (maths italic, math symbols and extensions) in normal and bold weights. The family also includes all OT1 and T1 encoded text fonts of various shapes, as well as fonts with most useful glyphs of the TS1 encoding. Macros for using the fonts with Plain \TeX , \LaTeX 2.09 and current \LaTeX are provided.

For further details (including samples) see <http://www.micropress-inc.com/fonts/bamath/bamain.htm>

HV Math (14 fonts) MicroPress Inc.

HV Math is a family of sans serif fonts, inspired by the Helvetica (TM) typeface. HV Math comprises the fonts necessary for mathematical typesetting (maths italic, maths symbols and extensions) in normal and bold weights. The family also in-

cludes all OT1 and T1 encoded text fonts of various shapes, as well as fonts with most useful glyphs of the TS1 encoding. Macros for using the fonts with Plain \TeX , \LaTeX 2.09 and current \LaTeX are provided. Bitmapped copies of the fonts are available free, on CTAN.

For further details (and samples) see <http://www.micropress-inc.com/fonts/hvmath/hvmain.htm>

Informal Math (7 outline fonts) MicroPress Inc.

Informal Math is a family of fanciful fonts loosely based on the Adobe's Tekton (TM) family, fonts which imitate handwritten text. Informal Math comprises the fonts necessary for mathematical typesetting (maths italic, maths symbols and extensions) in normal weight, as well as OT1 encoded text fonts in upright and oblique shapes. Macros for using the fonts with Plain \TeX , \LaTeX 2.09 and current \LaTeX are provided.

For further details (including samples) see <http://www.micropress-inc.com/fonts/ifmath/ifmain.htm>

Lucida Bright with Lucida New Math (25 fonts) Chuck Bigelow and Kris Holmes

Lucida is a family of related fonts including seriffed, sans serif, sans serif fixed width, calligraphic, blackletter, fax, Kris Holmes' connected handwriting font, *etc.*; they're not as 'spindly' as Computer Modern, with a large x-height, and include a larger set of maths symbols, operators, relations and delimiters than CM (over 800 instead of 384: among others, it also includes the AMS `msam` and `msbm` symbol sets). 'Lucida Bright Expert' (14 fonts) adds seriffed fixed width, another handwriting font, smallcaps, bold maths, upright 'maths italic', *etc.*, to the set. The distribution includes support for use with Plain \TeX and \LaTeX 2.09. Support under \LaTeX 2 ϵ is provided in PSNFSS (see question 82) thanks to Sebastian Rahtz and David Carlisle.

For a sample, see <http://www.YandY.com/download/chiron1b.pdf>

MathTime 1.1 (3 fonts) Publish or Perish (Michael Spivak)

The set contains maths italic, symbol, and extension fonts, designed to work well with Times-Roman. These are typically used with Times, Helvetica and Courier (which are resident on many printers, and which are supplied with some PC versions). In addition you may want to complement this basic set with Adobe's Times Smallcap, and perhaps the set of Adobe 'Math Pi' fonts, which include blackboard bold, blackletter, and script faces.

For a sample, see <http://www.YandY.com/download/chironmt.pdf>

MathTime Plus (12 fonts) Publish or Perish (Michael Spivak)

Adds bold and heavy versions of the basic math fonts, as well as upright math "italic". There are

also Greek letters for use in typesetting terms commonly used in physics, as well as regular and bold script faces. Both MathTime distributions include support for use with Plain \TeX and \LaTeX 2.09 (including code to link in Adobe Math Pi 2 and Math Pi 6). Support under \LaTeX 2 ϵ is provided in PSNFSS (see question 82) thanks to Frank Mittelbach and David Carlisle.

For a sample, see <http://www.YandY.com/download/mathplus.pdf>

TM Math (14 fonts) MicroPress Inc.

TM Math is a family of serif fonts, inspired by the Times (TM) typeface. TM Math comprises the fonts necessary for mathematical typesetting (maths italic, maths symbols and extensions) in normal and bold weights. The family also includes all OT1 and T1 encoded text fonts of various shapes, as well as fonts with most useful glyphs of the TS1 encoding. Macros for using the fonts with Plain \TeX , \LaTeX 2.09 and current \LaTeX are provided. Bitmapped copies of the fonts are available free, on CTAN.

For further details (and samples) see <http://www.micropress-inc.com/fonts/tmmath/tmmain.htm>

Belleek (3 fonts) Richard Kinch

Belleek is the upshot of Kinch's thoughts on how METAFONT might be used in the future: they were published simultaneously as METAFONT source, as Type 1 fonts, and as TrueType fonts. The fonts act as "drop-in" replacements for the basic MathTime set (as an example of "what might be done").

The paper outlining Kinch's thoughts, proceeding from considerations of the 'intellectual' superiority of METAFONT to evaluations of why its adoption is so limited and what might be done about the problem, is to be found at <http://truetex.com/belleek.pdf> (the paper is a good read, but exhibits the problems discussed in question 75 — don't try to read it on-screen in Acrobat reader).

PA Math PA Math is a family of serif fonts loosely based on the Palatino (TM) typeface. PAMath comprises the fonts necessary for mathematical typesetting (maths italics, maths, calligraphic and oldstyle symbols, and extensions) in normal and bold weights. The family also includes all OT1, T1 encoded text fonts of various shapes, as well as fonts with the most useful glyphs of the TS1 encoding. Macros for using the fonts with Plain \TeX , \LaTeX 2.09 and current \LaTeX are provided.

For further details (and samples) see <http://www.micropress-inc.com/fonts/pamath/pamain.htm>

mathpazo version 1.001 (5 fonts) by Diego Puga

The Pazo Math fonts are a family of type 1 fonts suitable for typesetting maths in combination with the Palatino family of text fonts. Four of the five fonts of the distribution are maths alphabets, in upright and italic shapes, medium and bold weights;

the fifth font contains a small selection of "blackboard bold" characters (chosen for their mathematical significance). Support under \LaTeX 2 ϵ is available in PSNFSS (see question 82); the fonts are licensed under the GPL, with legalese permitting the use of the fonts in published documents.

pxfonts set version 1.0 (26 fonts) by Young Ryu
The `pxfonts` set consists of

- virtual text fonts using Adobe Palatino (or the URW replacement used by *ghostscript*) with modified plus, equal and slash symbols;
- maths alphabets using times;
- maths fonts of all symbols in the computer modern maths fonts (`cmsy`, `cmmi`, `cmex` and the Greek letters of `cmr`)
- maths fonts of all symbols corresponding to the AMS fonts (`msam` and `msbm`);
- additional maths fonts of various symbols.

The text fonts are available in OT1, T1 and LY1 encodings, and TS encoded symbols are also available. The sans serif and monospaced fonts supplied with the `txfonts` set (see below) may be used with `pxfonts`; the `txfonts` set should be installed whenever `pxfonts` are. \LaTeX , *dvips* and PDF \TeX support files are included. The documentation (<http://www.tex.ac.uk/tex-archive/fonts/pxfonts/doc/pxfontsd4.pdf>) is readily available.

txfonts set version 3.1 (42 fonts) by Young Ryu
The `txfonts` set consists of

- virtual text fonts using Adobe Times (or the URW replacement used by *ghostscript*) with modified plus, equal and slash symbols;
- matching sets of sans serif and monospace ('typewriter') fonts (the sans serif set is based on Adobe Helvetica);
- maths alphabets using times;
- maths fonts of all symbols in the computer modern maths fonts (`cmsy`, `cmmi`, `cmex` and the Greek letters of `cmr`)
- maths fonts of all symbols corresponding to the AMS fonts (`msam` and `msbm`);
- additional maths fonts of various symbols.

The text fonts are available in OT1, T1 and LY1 encodings, and TS encoded symbols are also available. \LaTeX , *dvips* and PDF \TeX support files are included. The documentation (<http://www.tex.ac.uk/tex-archive/fonts/txfonts/doc/txfontsd4.pdf>) is readily available.

Adobe Lucida, LucidaSans and LucidaMath (12 fonts)

Lucida and LucidaMath are generally considered to be a bit heavy. The three maths fonts contain only the glyphs in the CM maths italic, symbol, and extension fonts. Support for using LucidaMath with \TeX is not very good; you will need to do some work reencoding fonts *etc.* (In some sense this set is the ancestor of the LucidaBright plus LucidaNewMath font set.)

Proprietary fonts Various sources.

Since having a high quality font set in scalable outline form that works with \TeX can give a publisher a real competitive advantage, there are some publishers that have paid (a lot) to have such font sets made for them. Unfortunately, these sets are not available on the open market, despite the likelihood that they're more complete than those that are.

Mathptm and mathpple Alan Jeffrey, Walter Schmidt and others.

This set contains maths italic, symbol, extension, and roman virtual fonts, built from Adobe Times, Symbol, Zapf Chancery, and the Computer Modern fonts. The resulting mixture is not really entirely acceptable, but can pass in some circumstances. The real advantage is that the mathptm and mathpple fonts are free, and the resulting PostScript files can be freely exchanged. Support under $\LaTeX 2_{\epsilon}$ is available in PSNFSS (see question 82).

The very limited selection of commercial maths font sets is a direct result of the fact that a maths font has to be explicitly designed for use with \TeX and as a result it is likely to lose some of its appeal in other markets. Furthermore, the \TeX market for commercial fonts is minute (in comparison, for example, to Microsoft TrueType font pack #1, which sold something like 10 million copies in a few weeks after release of Windows 3.1!).

Text fonts in Type 1 format are available from many vendors including Adobe, Monotype, Bitstream. Avoid cheap rip-offs: not only are you rewarding unethical behaviour, destroying the cottage industry of innovative type design, but you are *also* very likely to get junk. The fonts may not render well (or at all under ATM), may not have the 'standard' complement of 228 glyphs, or may not include metric files (needed to make TFM files).

TrueType remains the "native" format for Windows. Some \TeX implementations such as True \TeX (see question 55) use TrueType versions of Computer Modern and Times Maths fonts to render \TeX documents in Windows without the need for additional system software like ATM.

When choosing fonts, your own system environment may not be the only one of interest. If you will be sending your finished documents to others for further use, you should consider whether a given font format will introduce compatibility problems. Publishers may require TrueType exclusively because their systems are Windows-based, or Type 1 exclusively, because their systems are based on the early popularity of that format in the publishing industry. Many service bureaus don't care as long as you present them with a finished print file for their output device.

CM family collection: Browse `fonts/cm/ps-type1/bluesky`

AMS font collection: Browse `fonts/amsfonts/ps-type1`

Belleek fonts: `fonts/belleek/belleek.zip`

eulerum.sty and supporting metrics: `fonts/eulervm`

hvmath (free bitmapped version):

`fonts/micropress/hvmath`

pxfonts: `fonts/pxfonts`

tmmath (free bitmapped version):

`fonts/micropress/tmmath`

txfonts: `fonts/txfonts`

87 Including a PostScript figure in \LaTeX

\LaTeX has a standard package for graphics inclusion, rotation, colour, and other driver-related features. The package is documented in the second edition of Lamport's \LaTeX book, as well as in the *\LaTeX Graphics Companion* (see question 22). The \LaTeX package is also available in a form suitable for use with Plain \TeX .

The distribution itself comes with documentation, and a processed copy (`grfguide.ps`) is available in the distribution so that users can read documentation without first installing the package.

The *graphics* package comes with a relative, *graphicx*, which provides more convenient means of scaling and otherwise manipulating graphics. The packages are usually configured to the DVI processor you use by means of a `.cfg` file, but configuration by means of package options is also possible. The range of types of graphical file you may include differs according to the system you're using.

The figures themselves do not become part of the DVI file, but are only included when you use a DVI to PostScript conversion program. The `\special` commands (see question 38) used to pass pointers to the graphics files, and other information, are potentially different for every DVI processor (which is why the *graphics* package must be configured for the processor you use).

Since the `\special` commands used are typically not their own, some DVI previewers can't cope with them. More modern ones (notably *xdvi*, Mik \TeX 's *yap* and fp \TeX 's *windvi*) can pass the figure to a properly configured *ghostscript* installation for rendering into a bitmap for screen viewing.

There are two rather good documents on CTAN addressing figure production, with rather different emphasis. Keith Reckdahl's *epslatex* covers the standard \LaTeX facilities, as well as some of the supporting packages, notably *subfigure* and *psfrag*. Anil K. Goel's "Figures in \LaTeX " (*figsinltx*), covers the different ways in which you might generate figures, and the old ($\LaTeX 2.09$) ways of including them into documents.

epslatex.pdf: `info/epslatex.pdf`; the document is also available in PostScript format as `info/epslatex.ps`

figsinltx: `info/figsinltx.ps`

ghostscript: Browse `nonfree/support/ghostscript`

graphics: The whole bundle for \LaTeX (including *graphicx.sty*) is found in `macros/latex/required/graphics`; to use the packages with Plain \TeX , you should also acquire:

graphicx.tex: `macros/plain/graphics` which contains various wrappers and emulations of commands for the use of the \LaTeX version.

psfrag.sty: `macros/latex/contrib/supported/psfrag`

subfigure.sty: macros/latex/contrib/supported/
subfigure

88 Weird characters in *dvips* output

You've innocently generated output, using *dvips*, and there are weird transpositions in it: for example, the fi ligature has appeared as a £ symbol. This is an unwanted side-effect of the precautions about generating PostScript for PDF outlined in question 75. The `-G1` switch discussed in that question is appropriate for Knuth's text fonts, but doesn't work with text fonts that don't follow Knuth's patterns (such as fonts supplied by Adobe).

If the problem arises, suppress the `-G1` switch: if you were using it explicitly, *don't*; if you were using `-Ppdf`, add `-G0` to suppress the implicit switch in the pseudo-printer file.

N Bibliographies and citations

89 Creating a bibliography style

It is possible to write your own: the standard bibliography styles are distributed in a commented form, and there is a description of the language (see question 30). However, it must be admitted that the language in which BIBTEX styles are written is pretty obscure, and one would not recommend anyone who's not a confident programmer to write their own, though minor changes to an existing style may be within the grasp of many.

If your style isn't too 'far out', you can probably generate it by using the facilities of the *custom-bib* bundle. This contains a file `makebst.tex`, which runs you through a text menu to produce a file of instructions, with which you can generate your own `.bst` file. This technique doesn't deal with entirely new styles of document (the present author needed "standards committee papers" and "ISO standards" for his dissertation; another commonly-required type is the Web page — see question 93).

BIBTEX documentation: `biblio/bibtex/distrib/doc`

`makebst.tex`: Distributed with
`macros/latex/contrib/supported/custom-bib`

90 Capitalisation in BibTEX

The standard BIBTEX bibliography styles impose fixed ideas about the capitalisation of titles of things in the bibliography. While this is not unreasonable by BIBTEX's lights (the rules come from the *Chicago Manual of Style*) it can be troublesome, since BIBTEX fails to recognise special uses (such as acronyms).

The solution is to enclose the letter or letters, whose capitalisation BIBTEX should not touch, in braces, as:

```
title = {The {THE} operating system},
```

Sometimes you find BIBTEX changing the case of a single letter inappropriately. No matter: the technique can be applied to single letters, as in:

```
title = {Te{X}niques and tips},
```

There's more on the subject in the BIBTEX documentation (see question 30).

91 'String too long' in BibTEX

The BIBTEX diagnostic "Warning—you've exceeded 1000, the `global-string-size`, for entry foo" usually arises from a very large abstract or annotation included in the database. The diagnostic usually arises because of an infelicity in the coding of `abstract.bst`, or styles derived from it. (One doesn't ordinarily output annotations in other styles.)

The solution is to make a copy of the style file (or get a clean copy from CTAN — `biblio/bibtex/contrib/abstract.bst`), and rename it (e.g., on a long file-name system to `abstract-long.bst`). Now edit it: find function `output.nonnull` and

- change its first line (line 60 in the version on CTAN) from `"{ 's :="` to `"{ swap$"`, and
- delete its last line, which just says `"s"` (line 84 in the version on CTAN).

Finally, change your `\bibliographystyle` command to refer to the name of the new file.

This technique applies equally to any bibliography style: the same change can be made to any similar `output.nonnull` function.

If you're reluctant to make this sort of change, the only way forward is to take the entry out of the database, so that you don't encounter BIBTEX's limit, but you may need to retain the entry because it will be included in the typeset document. In such cases, put the body of the entry in a separate file:

```
@article{long.boring,  
  author = "Fred Verbose",  
  ...  
  abstract = "{\input{abstracts/long.tex}}"  
}
```

In this way, you arrange that all BIBTEX has to deal with is the file name, though it will tell TEX (when appropriate) to include all the long text.

92 BibTEX doesn't understand my lists of names

BIBTEX has a strict syntax for lists of authors' (or editors') names in the BIBTEX data file; if you write the list of names in a "natural"-seeming way, the chances are you will confuse BIBTEX, and the output produced will be quite different from what you had hoped.

Names should be expressed in one of the forms

```
First Last  
Last, First  
Last, Suffix, First
```

and lists of names should be separated with "and". For example:

```
AUTHOR = {Fred Q. Bloggs, John P. Doe \&  
          Robin Fairbairns}
```

falls foul of two of the above rules: a syntactically significant comma appears in an incorrect place, and `\&` is being used as a name separator. The output of the above might be something like:

```
John P. Doe \& Robin Fairbairns Fred Q. Bloggs  
because "John P. Doe & Robin Fairbairns" has become  
the 'first name', while "Fred Q. Bloggs" has become the
```

‘last name’ of a single person. The example should have been written:

```
AUTHOR = {Fred Q. Bloggs and John P. Doe and  
Robin Fairbairns}
```

Some bibliography styles implement clever acrobatics with very long author lists. You can force truncation by using the pseudo-name “others”, which will usually translate to something like “*et al*” in the typeset output. So, if Mr. Bloggs wanted to distract attention from his co-authors, he would write:

```
AUTHOR = {Fred Q. Bloggs and others}
```

93 Citing URLs with BibTeX

There is no citation type for URLs, *per se*, in the standard BibTeX styles, though Oren Patashnik (the author of BibTeX) is considering developing one such for use with the long-awaited BibTeX version 1.0.

The actual information that need be available in a citation of an URL is discussed at some length in the publicly available on-line extracts of ISO 690–2, available via <http://www.nlc-bnc.ca/iso/tc46sc9/standard/690-2e.htm>; the techniques below do *not* satisfy all the requirements of ISO 690–2, but they offer a solution that is at least available to users of today’s tools.

Until the new version arrives, the simplest technique is to use the `howpublished` field of the standard styles’ `@misc` function. Of course, the strictures about typesetting URLs (see question 134) still apply, so the entry will look like:

```
@misc{...,  
...,  
howpublished = "\url{http://...}"  
}
```

Another possibility is that some conventionally-published paper, technical report (or even book) is also available on the Web. In such cases, a useful technique is something like:

```
@techreport{...,  
...,  
note = "Also available as \url{http://...}"  
}
```

There is good reason to use the `url` or `hyperref` packages in this context, since (by default) the `\url` command ignores spaces in its argument. BibTeX has a habit of splitting lines it considers excessively long, and if there are no space characters for it to use as ‘natural’ break-points, BibTeX will insert a comment (“%”) character ... which is an acceptable character in an URL, so that `\url` will typeset it. If you’re using `url`, the way around the problem is to insert odd spaces inside the URL itself in the `.bib` file, to enable BibTeX to make reasonable decisions about breaking the line. Note that the version of `\url` that comes with recent versions of the `hyperref` package doesn’t suffer from the ‘%-end of line’ problem: `hyperref` spots the problem, and suppresses the unwanted characters.

A possible alternative approach is to use the `harvard` package (if its citation styles are otherwise satisfactory for you). *Harvard* bibliography styles all include a “`url`”

field in their specification; however, the typesetting offered is somewhat feeble (though it does recognise and use *LaTeX2HTML* macros if they are available, to create hyperlinks).

```
harvard: macros/latex/contrib/supported/harvard
```

```
hyperref: macros/latex/contrib/supported/  
hyperref
```

```
url: macros/latex/contrib/other/misc/url.sty
```

94 Using BibTeX with Plain TeX

The file `btzmac.tex` contains macros and documentation for using BibTeX with Plain TeX, either directly or with Eplain (see question 14). See question 30 for more information about BibTeX itself.

```
btzmac.tex: macros/eplain/btzmac.tex
```

95 Separate bibliographies per chapter?

A separate bibliography for each ‘chapter’ of a document can be provided with the package `chapterbib` (which comes with a bunch of other good bibliographic things). The package allows you a different bibliography for each `\included` file (i.e., despite the package’s name, the availability of bibliographies is related to the component source files of the document rather than to the chapters that logically structure the document).

The package `bibunits` ties bibliographies to logical units within the document: the package will deal with chapters and sections (as defined by L^AT_EX itself) and also defines a `bibunit` environment so that users can select their own structuring.

```
chapterbib.sty: macros/latex/contrib/supported/  
cite
```

```
bibunits.sty: macros/latex/contrib/supported/  
bibunits
```

96 Multiple bibliographies?

If you’re thinking of multiple bibliographies tied to some part of your document (such as the chapters within the document), please see question 95.

For more than one bibliography, there are three options.

The `multibbl` package offers a very simple interface: it redefines the bibliography commands so that each time you use any one of them, you tell it which bibliography you want the citations to go to or to come from. The `\bibliography` command itself also takes a further extra argument that says what title to use for the resulting section or chapter (i.e., it patches `\refname` and `\bibname` — see question 187 — in a *babel*-safe way.

The `multibib` package allows you to define a series of “additional topics”, each of which comes with its own series of bibliography commands (e.g., a topic “`sec`” for *secondary literature* would have commands `\citesec`, `\nocitesec`, `\bibliographystylesec` and `\bibliographysec`. You can pull citations from any bibliography (`.bib` file) into any one of the multiple bibliographies (indeed, they may all come from the same `.bib` file).

The `bibtopic` package allows you separately to cite several different bibliographies. At the appropriate place in

your document, you put a sequence of `btSect` environments (each of which specifies a bibliography database to scan) to typeset the separate bibliographies. Thus, one might have

```
\begin{btSect}{books}
\section{References from books}
\btPrintCited
\end{btSect}
\begin{btSect}{articles}
\section{References from articles}
\btPrintCited
\end{btSect}
```

There is also a command `\btPrintNotCited`, which gives the rest of the content of the database (if nothing has been cited from the database, this is equivalent to L^AT_EX standard `\nocite*`).

bibtopic.sty: macros/latex/contrib/supported/
bibtopic

multibib.sty: macros/latex/contrib/supported/
multibib

97 Putting bibliography entries in text

This is a common requirement for journals and other publications in the humanities. Sometimes the requirement is for the entry to appear in the running text of the document, while other styles require that the entry appear in a footnote.

Options for entries in running text are

- The package *bibentry*, which puts slight restrictions on the format of entry that your `.bst` file generates, but is otherwise undemanding of the bibliography style.
- The package *inlinebib*, which requires that you use its `inlinebib.bst`
- The package *jurabib*, which was originally targeted at German law documents, and has comprehensive facilities for the manipulation of citations. The package comes with four bibliography styles that you may use: `jurabib.bst`, `jhuman.bst` and two Chicago-like ones.

Options for entries in footnotes are

- The package *footbib*, and
- The package *jurabib*, again.

bibentry.sty: Distributed with
macros/latex/contrib/supported/natbib

footbib.sty: macros/latex/contrib/supported/
footbib

inlinebib.sty: biblio/bibtex/contrib/inlinebib

jurabib.sty: macros/latex/contrib/supported/
jurabib

98 Sorting and compressing citations

If you give L^AT_EX `\cite{fred,joe,harry,min}`, its default commands could give something like “[2,6,4,3]”; this looks awful. One can of course get the things in order by rearranging the keys in the `\cite` command, but who

wants to do that sort of thing for no more improvement than “[2,3,4,6]”?

The *cite* package sorts the numbers and detects consecutive sequences, so creating “[2–4,6]”. The *natbib* package, with the `numbers` and `sort&compress` options, will do the same when working with its own numeric bibliography styles (`plainnat.bst` and `unsrtnat.bst`).

If you might need to make hyperreferences to your citations, *cite* isn’t adequate. If you add the *hypernat* package:

```
\usepackage[...]{hyperref}
\usepackage[numbers,sort&compress]{natbib}
\usepackage{hypernat}
...
\bibliographystyle{plainnat}
```

the *natbib* and *hyperref* packages will interwork.

cite.sty: macros/latex/contrib/supported/cite

hypernat.sty: macros/latex/contrib/supported/
misc/hypernat.sty

hyperref.sty: macros/latex/contrib/supported/
hyperref

plainnat.bst: macros/latex/contrib/supported/
hyperref

unsrtnat.bst: macros/latex/contrib/supported/
hyperref

99 Multiple citations

A convention sometimes used in physics journals is to “collapse” a group of related citations into a single entry in the bibliography. BIB_TE_X, by default, can’t cope with this arrangement, but the *mcite* package deals with the problem.

The package overloads the `\cite` command, so that citations of the form `\cite{paper1,paper2}` appear in the document as a single citation, and appear arranged appropriately in the bibliography itself. You need to alter the bibliography style (`.bst`) file you use; the package documentation tells you how to do that.

mcite.sty: macros/latex/contrib/supported/mcite

100 Listing all my Bib_TE_X entries

L^AT_EX and BIB_TE_X co-operate to offer special treatment of this requirement. The command `\nocite{*}` is specially treated, and causes BIB_TE_X to generate bibliography entries for every entry in each `.bib` file listed in your `\bibliography` statement, so that after a L^AT_EX–BIB_TE_X–L^AT_EX sequence, you have a document with the whole thing listed.

Note that L^AT_EX *doesn’t* produce “Citation ... undefined” or “There were undefined references” warnings in respect of `\nocite{*}`. This isn’t a problem if you’re running L^AT_EX “by hand” (you *know* exactly how many times you have to run things), but the lack might confuse automatic processors that scan the log file to determine whether another run is necessary.

101 Making HTML of your Bibliography

A neat solution is offered by the *noTeX* bibliography style. This style produces a `.bbl` file which is in fact a series of HTML ‘P’ elements of class `noTeX`, and which may therefore be included in an HTML file. Provision is made for customising your bibliography so that its content when processed by *noTeX* is different from that presented when it is processed in the ordinary way by (L)T_EX.

A more conventional translator is the *awk* script *bbl2html*, which translates the `.bbl` file you’ve generated: a sample of the script’s output may be viewed on the web, at <http://rikblok.cjb.net/lib/refs.html>

```
bbl2html.awk: biblio/bibtex/utils/bbl2html.awk
```

```
noTeX.bst: biblio/bibtex/utils/noTeX.bst
```

O Installing (L)T_EX files

102 Installing a new package

The first step in installing a new package for your L^AT_EX system is to find where it is (see question 48) and then to get it, usually from CTAN (see question 49).

Ordinarily, you should download the whole distribution directory; the only occasion when this is not necessary is when you are getting something from one of the (L)T_EX contributed “misc” directories on CTAN; these directories contain collections of single files, which are supposedly complete in themselves.

A small package (*smallpack*) might be just a single `.sty` file (typically `smallpack.sty`) with the usage instructions either included as comments in the file or in a separate user manual or README file. More often a package *pack* will come as a pair of files, `pack.ins` and `pack.dtx`, written to be used with the L^AT_EX *doc* system. The package code must be extracted from these files. If there is a README file as part of the package distribution, read it!

In the *doc* system, the user manual and documented package code is in the `.dtx` file, and the `.ins` file contains L^AT_EX instructions on what code should be extracted from the `.dtx` file. To unpack a *doc* package (*pack*), do the following:

- Run latex on *pack.ins*. This will generate one or more files (normally a *pack.sty* file but there may be others depending on the particular package).
- Run latex on *pack.dtx* as a start to getting the user manual and possibly a commented version of the package code.
- Run latex again on *pack.dtx*, which should resolve any references and generate a Table of Contents if it was called for.
- L^AT_EX may have said “No file `pack.ind`”; this is the source for the command index; if you want the index, process the raw material with:
 `makeindex -s gind.ist pack`
 and run L^AT_EX again.
- Print and read `pack.dvi`

Sometimes a user manual is supplied separately from the `.dtx` file. Process this *after* doing the above, just in case the user manual uses the package it is describing.

Almost the final stage of the installation is to put the package file(s) ‘where L^AT_EX can find them’. Where the magic place is, and how you put the files there depends on your particular L^AT_EX system and how it is set up (see question 43 for general principles, question 103 for specific advice).

The final stage is to tell L^AT_EX that there is a new file, or files, that it should be able to go and find. Most free L^AT_EX systems maintain a database of the names and locations of latex-related files to enable faster searching. In these systems the database must be updated, using the script or program provided with the distribution for this purpose.

teT_EX, fpT_EX Run:

```
texhash
```

web2c On a current *web2c* distribution, `texhash` ought to work; if it doesn’t, run:

```
mktexlsr
```

MikT_EX On a *MikTeX* distribution earlier than v2.0, do:

```
Start→Programs→MikTeX→Maintenance→
```

```
Refresh filename database
```

```
or get a DOS window and run:
```

```
initexmf --update-fndb
```

On a *MikTeX* distribution v2.0 or later, do:

```
Start→Programs→MikTeX 2→MikTeX Options,  
and press the Update filename database button.
```

Remember that a `\usepackage{pack}` command must be put in the preamble of each document in which you want to use the *pack* package.

103 Where to put new files

Where precisely you put files that you have downloaded does depend on what T_EX distribution you have. However, assuming that you have one of the modern TDS-compliant distributions (such as teT_EX, fpT_EX or mikT_EX) there are some general rules that you can follow:

(1) Always install new files in a local `texmf` tree. The root directory will be named something like:

```
teTeX:      /usr/share/texmf-local/  
fpTeX:     c:\fptex\texmf.local\  
mikTeX:    c:\localtexmf\
```

Let’s write \$TEXMF for this root, whatever it is for your system.

(2) In your local `texmf` tree, imitate the directory structure in your main tree. Here’s some examples of where files of given extensions should go:

```
.sty, .cls or .fd: $TEXMF/tex/latex/<package>/  
.dvi, .ps or .pdf: $TEXMF/doc/latex/<package>/  
.tfm: $TEXMF/fonts/tfm/<supplier>/<font>/  
.vf: $TEXMF/fonts/vf/<supplier>/<font>/  
.afm: $TEXMF/fonts/afm/<supplier>/<font>/  
.pfb: $TEXMF/fonts/type1/<supplier>/<font>/  
.ttf: $TEXMF/fonts/truetype/<supplier>/<font>/
```

Where of course *<package>*, ** and *<supplier>* depend upon what’s appropriate for the individual file.

Operating systems and applications need to know where to find files: many files that they need are “just named” — the user doesn’t necessarily know *where* they are, but knows to ask for them. The commonest case, of course, is the commands whose names you type to a shell (yes, even Windows’ “MS-DOS prompt”) are using a shell to read what you type: many of the commands simply involve loading and executing a file, and the `PATH` variable tells the shell where to find those files.

Modern T_EX implementations come with a bunch of search paths built in to them. In most circumstances these paths are adequate, but one sometimes needs to extend them to pick up files in strange places: for example, we may wish to try a new bundle of packages before installing them ‘properly’ (see question 102). To do this, we need to change the relevant path as T_EX perceives it. However, we don’t want to throw away T_EX’s built-in path (all of a sudden, T_EX won’t know how to deal with all sorts of things).

To *extend* a T_EX path, we define an operating system environment variable in ‘path format’, but leaving a gap which T_EX will fill with its built-in value for the path. The commonest case is that we want to place our extension in front of the path, so that our new things will be chosen in preference, so we leave our ‘gap to be filled’ at the end of the environment variable. The syntax is simple (though it depends which shell you’re actually using): so on a Unix-like system, using the *bash* shell, the job might be done like:

```
export TEXINPUTS=/tmp:
```

while in a Windows system, within a MS-DOS window, it would be:

```
set TEXINPUTS=C:/temp;
```

In either case, we’re asking T_EX to load files from the root disc temporary files directory; in the Unix case, the “empty slot” is designated by putting the path separator ‘:’ on its own at the end of the line, while in the Windows case, the technique is the same, but the path separator is ‘;’.

Note that in either sort of system, the change will only affect instances of T_EX that are started from the shell where the environment variable was set. If you run T_EX from another window, it will use the original input path. To make a change of input path that will “stick” for all windows, set the environment variable in your login script or profile (or whatever) in a Unix system and log out and in again, or in `autoexec.bat` in a Windows system, and reboot the system.

While all of the above has talked about where T_EX finds its macro files, it’s applicable to pretty much any sort of file any T_EX-related program reads — there are lots of these paths, and of their corresponding environment variables. In a *web2c*-based system, the copious annotations in the `texmf.cnf` system configuration file help you to learn which path names correspond to which type of file.

P Adjusting the typesetting

P.1 Alternative document classes

105 Formatting a thesis in L^AT_EX

Thesis styles are usually very specific to your University, so it’s usually not profitable to ask around for a package outside your own University. Since many Universities (in their eccentric way) still require double-spacing, you may care to refer to question 127. If you want to write your own, a good place to start is the University of California style, but it’s not worth going to a lot of trouble. (If officials won’t allow standard typographic conventions, you won’t be able to produce an aesthetically pleasing document anyway!)

```
UC thesis style: macros/latex/contrib/supported/
                ucthesis
```

106 Setting papers for journals

Publishers of journals have a wide range of requirements for the presentation of papers, and while many publishers do accept electronic submissions in (L^A)T_EX, they don’t often submit recommended macros to public archives.

Nevertheless, there are considerable numbers of macros of one sort or another available on CTAN; searching for your journal name in the CTAN catalogue (see question 50) may well turn up what you’re seeking.

Failing that, you may be well advised to contact the prospective publisher of your paper; many publishers have macros on their own web sites, or otherwise available only upon application.

Check that the publisher is offering you macros suitable to an environment you can use: a few still have no macros for current L^AT_EX, for example, claiming that L^AT_EX 2.09 is good enough. . .

Some publishers rekey anything sent them anyway, so that it doesn’t really matter what macros you use. Others merely encourage you to use as few extensions of a standard package as possible, so that they will find it easy to transform your paper to their own internal form.

107 A ‘report’ from lots of ‘article’s

This is a requirement, for example, if one is preparing the proceedings of a conference whose papers were submitted in L^AT_EX.

The nearest thing to a canned solution is Peter Wilson’s *combine* class; it defines the means to ‘\import’ entire documents, and provides means of specifying significant features of the layout of the document, as well as a global table of contents, and so on. An auxiliary package, *combinet*, allows use of the `\titles` and `\authors` (etc.) of the `\imported` documents to appear in the global table of contents.

A more ‘raw’ toolkit is offered by Matt Swift’s *includex* and *moredefs* packages, both part of the *frankenstein* bundle) offer a possible way forward.

Includex enables you to ‘\includedoc’ complete articles (in the way that you ‘\include’ chapter files in an ordinary report). It doesn’t do the whole job for you, though. You need to analyse the package use of the individual papers, and ensure that a consistent set is loaded in the preamble of the main report.

A completely different approach is to use the *pdfpages* package, and to include articles submitted in PDF format into a PDF document produced by PDF \LaTeX . The package defines an `\includepdf` command, which takes arguments similar to those of the `\includegraphics` command. With keywords in the optional argument of the command, you can specify which pages you want to be included from the file named, and various details of the layout of the included pages.

combine.cls: macros/latex/contrib/supported/combine

combinet.sty: macros/latex/contrib/supported/combine

includex.sty: Distributed in the “unsupported” part of macros/latex/contrib/supported/frankenstein

moredefs.sty: Distributed as part of macros/latex/contrib/supported/frankenstein

pdfpages.sty: macros/latex/contrib/supported/pdfpages

108 Curriculum Vitae (Resumé)

A framework class, *vita*, for *Curricula Vitae* is provided by Andrej Brodnik.

The class can be customised both for subject (example class option files are offered for both computer scientists and singers), and for language (both the options provided are available for both English and Slovene). Extensions may be written by creating new class option files, or by using macros defined in the class to define new entry types, etc.

Didier Verna’s class, *curve*, is based on a model in which the CV is made of a set of *rubrics* (each one dealing with a major item that you want to discuss, such as ‘education’, ‘work experience’, etc. The class’s documentation is supported by a couple of example files, and an emacs mode is provided.

curve.cls: macros/latex/contrib/supported/curve

vita.cls: macros/latex/contrib/other/vita

109 Letters and the like

\LaTeX itself provides a *letter* document class, which is widely disliked; the present author long since gave up trying with it. If you nevertheless want to try it, but are irritated by its way of vertically-shifting a single-page letter, try the following hack:

```
\makeatletter
\let\@texttop\relax
\makeatother
```

in the preamble of your file.

Doing-it-yourself is a common strategy; Knuth (for use with plain \TeX , in the \TeX book), and Kopka and Daly (in their Guide to \LaTeX) offer worked examples.

Nevertheless, there *are* contributed alternatives — in fact there are an awfully large number of them: the following list, of necessity, makes but a small selection.

The largest, most comprehensive, class is *newlfm*; the *lfm* part of the name implies that the class can create

letters, faxes and memoranda. The documentation is voluminous, and the package seems very flexible.

Axel Kielhorn’s *akletter* class is the only other one, recommended for inclusion in this FAQ, whose documentation is available in English.

The *dinbrief* class, while recommended, is only documented in German.

There are letter classes in each of the excellent *koma-script* (*scrlettr*: documentation is available in English) and *ntgclass* (*brief*: documentation in Dutch only) bundles. While these are probably good (since the bundles themselves inspire trust) they’ve not been specifically recommended by any users.

akletter.cls: macros/latex/contrib/supported/akletter

brief.cls: Part of the macros/latex/contrib/supported/ntgclass bundle

dinbrief.cls: macros/latex/contrib/supported/dinbrief

newlfm.cls: macros/latex/contrib/supported/newlfm

scrlettr.cls: Part of the macros/latex/contrib/supported/koma-script bundle

P.2 Document structure

110 The style of document titles

Limited resources in the titlepage option/environment in the standard styles, inflexibility of `\maketitle...` non-standard things in the title (such as logo images, etc.)

The *titling* package provides a number of facilities that permit manipulation of the appearance of a `\maketitle` command, the `\thanks` commands within it, and so on. The package also defines a `titlingpage` environment, that offers something in between the standard classes’ `titlepage` option and the `titlepage` environment, and is itself somewhat configurable.

titling.sty: macros/latex/contrib/supported/titling

111 The style of section headings

Suppose that the editor of your favourite journal has specified that section headings must be centred, in small capitals, and subsection headings ragged right in italic, but that you don’t want to get involved in the sort of programming described in *The \LaTeX Companion* (see question 22; the programming itself is discussed in question 191). The following hack will probably satisfy your editor. Define yourself new commands

```
\newcommand{\ssection}[1]{%
  \section[#1]{\centering\sc #1}}
\newcommand{\ssubsection}[1]{%
  \subsection[#1]{\raggedright\it #1}}
```

and then use `\ssection` and `\ssubsection` in place of `\section` and `\subsection`. This isn’t perfect: section numbers remain in bold, and starred forms need a separate redefinition. Also, this will not work if you are using the prototype NFSS with \LaTeX 2.09, because the font-changing commands behave differently there.

The package *sectsty* provides an easy-to-use set of tools to do this job, while the package *titlesec* permits more advanced usage as well. (*Titlesec* comes with a second package, *titletoc*, which is used to adjust the format of table of contents entries.)

The *fncychap* package provides a nice collection of customised chapter heading designs. The *anonchap* package provides a simple means of typesetting chapter headings “like section headings” (i.e., without the “Chapter” part of the heading); the *tocbibind* package provides the same commands, in pursuit of another end.

anonchap.sty: macros/latex/contrib/supported/misc/anonchap.sty

fncychap.sty: macros/latex/contrib/supported/fncychap

sectsty.sty: macros/latex/contrib/supported/sectsty

titlesec.sty: macros/latex/contrib/supported/titlesec

tocbibind.sty: macros/latex/contrib/supported/tocbibind

112 Indent after section headings

L^AT_EX implements a style that doesn’t indent the first paragraph after a section heading. There are coherent reasons for this, but not everyone likes it. The *indentfirst* package suppresses the mechanism, so that the first paragraph is indented.

indentfirst.sty: Distributed as part of macros/latex/required/tools

113 How to create a \subsubsection

L^AT_EX’s set of “sections” stops at the level of `\subsubsection`. This reflects a design decision by L^Amp^ort — for, after all, who can reasonably want a section with such huge strings of numbers in front of it?

In fact, L^AT_EX standard classes *do* define “sectioning” levels lower than `\subsubsection`, but they don’t format them like sections (they’re not numbered, and the text is run-in after the heading). These deeply inferior section commands are `\paragraph` and `\subparagraph`; you can (if you *must*) arrange that these two commands produce numbered headings, so that you can use them as `\subsubsubsections` and lower.

The *titlesec* allows you to adjust the definitions of the sectioning macros, and it may be used to transform a `\paragraph`’s typesetting so that it looks like that of a `\section`.

If you want to program the change yourself, you’ll find that the commands (`\section` all the way down to `\subparagraph`) are defined in terms of the internal `\@startsection` command, which takes 6 arguments. Before attempting this sort of work, you are well advised to read the L^AT_EX sources (`1tsect.dtx` in the L^AT_EX distribution) and the source of the standard packages (`classes.dtx`). The L^AT_EX companion (see question 22) discusses use of `\@startsection` for this sort of thing.

L^AT_EX source: macros/latex/base

titlesec.sty: macros/latex/contrib/supported/titlesec

114 The style of captions

Changes to the style of captions may be made by redefining the commands that produce the caption. So, for example, `\fnum@figure` (which produces the float number for figure floats) may be redefined:

```
\renewcommand{\fnum@figure}%
{\textbf{Fig.~\thefigure}}
```

which will cause the number to be typeset in bold face. (Note that the original definition used `\figurename` — see question 187.) More elaborate changes can be made by patching the `\caption` command, but since there are packages to do the job, such changes (which can get rather tricky) aren’t recommended for ordinary users.

The *float* package provides some control of the appearance of captions, though it’s principally designed for the creation of non-standard floats). The *caption2* and *ccaption* (note the double “c”) packages provide a range of different formatting options; *ccaption* is the more modern and comprehensive, and also provides ‘continuation’ captions and captions that can be placed outside of float environments.

caption2.sty: macros/latex/contrib/supported/caption; note that *caption2*’s documentation is incomplete, and the documentation of the older *caption* should be typeset as well as that of the newer package.

ccaption.sty: macros/latex/contrib/supported/ccaption

float.sty: macros/latex/contrib/supported/float

115 Alternative head- and footlines in L^AT_EX

The standard L^AT_EX document classes define a small set of ‘page styles’ which (in effect) specify head- and footlines for your document. The set defined is very restricted, but L^AT_EX is capable of much more; people occasionally set about employing L^AT_EX facilities to do the job, but that’s quite unnecessary — Piet van Oostrum has already done the work.

The package *fancyhdr* provides simple mechanisms for defining pretty much every head- or footline variation you could want; the directory also contains some (rather good) documentation and one or two smaller packages. *Fancyhdr* also deals with the tedious behaviour of the standard styles with initial pages (see question 122), by enabling you to define different page styles for initial and for body pages.

fancyhdr.sty: macros/latex/contrib/supported/fancyhdr

116 Changing the margins in L^AT_EX

Changing the size of the body of a L^AT_EX document’s text is a surprisingly difficult task: the best advice to the beginner is “don’t do it”. There are interactions between fundamental T_EX constraints, constraints related to the design of L^AT_EX, and good typesetting and design practice, that mean that any change must be very carefully considered, both to ensure that it “works” and to ensure that the result is pleasing to the eye.

Lamport's warning in his section on 'Customizing the Style' needs to be taken seriously. One-inch margins on A4 paper are fine for 10- or 12-pitch typewriters, but not for 10pt (or even 11pt or 12pt) type because readers find such wide, dense, lines difficult to read: there should ideally be no more than 75 characters per line (though the constraints change for two-column text).

L^AT_EX's controls allow you to change the distance from the edges of a page to the left and top edges of your typeset text, and the width and height of the text. Changing the last two requires more skill than you might expect: the height should bear a certain relationship to `\baselineskip`, and the width should be constrained as mentioned above.

The controls are expressed as a set of page parameters; they are somewhat complex, and it is easy to get their interrelationships wrong when redefining the page layout. The *layout* package defines a `\layout` command which draws a diagram of your existing page layout, with the dimensions (but not their interrelationships) shown. This FAQ recommends that you use a package to establish consistent settings of the parameters: the interrelationships are taken care of in the established packages, without you needing to think about them.

The 'ultimate' tool for adjusting the dimensions and position of the printed material on the page is the *geometry* package; a very wide range of adjustments of the layout may be relatively straightforwardly programmed, and documentation in the `.dtx` file (see question 39) is good and comprehensive.

Somewhat simpler to use is the *vmargin* package, which has a canned set of paper sizes (a superset of that provided in L^AT_EX 2_ε), provision for custom paper, margin adjustments and provision for two-sided printing.

If you're still eager to "do it yourself", start by familiarising yourself with L^AT_EX's page layout parameters. For example, see section C.5.3 of the L^AT_EX manual (pp. 181–182), or corresponding sections in many of the other good L^AT_EX manuals (see question 22). The parameters `\oddsidemargin` and `\evensidemargin` are so-called because it is conventionally taken that odd-numbered pages appear on the right-hand side of a two-page spread ('recto') and even-numbered pages on the left-hand side ('verso'). Both parameters refer to the *left-hand* margin; the right-hand margin is specified by implication, from the size of `\textwidth`. The origin in DVI coordinates is one inch from the top of the paper and one inch from the left side; positive horizontal measurements extend right across the page, and positive vertical measurements extend down the page. Thus, for margins closer to the left and top edges of the page than 1 inch, the corresponding parameters, *i.e.*, `\evensidemargin`, `\oddsidemargin`, `\topmargin`, can be set to negative values.

Another surprise is that you cannot change the width or height of the text within the document, simply by modifying the text size parameters. The simple rule is that the parameters should only be changed in the preamble of the document, *i.e.*, before the `\begin{document}` statement. To adjust text width within a document we define an environment:

```
\newenvironment{changemargin}[2]{%
```

```
\begin{list}{}{-%
\setlength{\topsep}{0pt}%
\setlength{\leftmargin}{#1}%
\setlength{\rightmargin}{#2}%
\setlength{\listparindent}{\parindent}%
\setlength{\itemindent}{\parindent}%
\setlength{\parsep}{\parskip}%
}%
```

```
\item[]{\end{list}}
```

This environment takes two arguments, and will indent the left and right margins, respectively, by the parameters' values. Negative values will cause the margins to be narrowed, so `\begin{changemargin}{-1cm}{-1cm}` narrows the left and right margins by 1cm.

The *chnngpage* package provides ready-built commands to do the above; it includes provision for changing the shifts applied to your text according to whether you're on an odd or an even page of a two-sided document. The package's documentation (in the file itself) suggests a strategy for changing text dimensions between pages — as mentioned above, changing the text dimensions within the body of a page may lead to unpredictable results.

chnngpage.sty: macros/latex/contrib/supported/misc/chnngpage.sty

geometry.sty: macros/latex/contrib/supported/geometry

layout.sty: Distributed as part of macros/latex/required/tools

vmargin.sty: macros/latex/contrib/supported/vmargin

117 Wide figures in two-column documents

Floating figures and tables ordinarily come out the same width as the page, but in two-column documents they're restricted to the width of the column. This is sometimes not good enough; so there are alternative versions of the float environments — in two-column documents, `figure*` provides a floating page-wide figure (and `table*` a page-wide table) which will do the necessary.

The "*"ed float environments can only appear at the top of a page, or on a whole page — `h` or `b` float placement directives are simply ignored.

Unfortunately, page-wide equations can only be accommodated inside float environments. You should include them in `figure` environments, or use the *float* or *ccaption* package to define a new float type.

ccaption.sty: macros/latex/contrib/supported/ccaption

float.sty: macros/latex/contrib/supported/float

118 1-column abstract in 2-column document

One often requires that the abstract of a paper should appear across the entire page, even in a two-column paper. The required trick is:

```
\documentclass[twocolumn]{article}
...
\begin{document}
... % \author, etc
\twocolumn[
\begin{@twocolumnfalse}
```

```

\maketitle
\begin{abstract}
...
\end{abstract}
\end{@twocolumnfalse}
]

```

Unfortunately, with the above `\thanks` won't work in the `\author` list. If you need such specially-numbered footnotes, you can make them like this:

```

\title{Demonstration}
\author{Me, You\thanks{}}
\twocolumn[
... as above ...
]
{
\renewcommand{\thefootnote}%
{\fnsymbol{footnote}}
\footnotetext[1]{Thanks for nothing}
}

```

and so on.

As an alternative, among other facilities the *abstract* package (available from `macros/latex/contrib/supported/abstract`) provides a `\saythanks` command and a `oncolabstract` environment which remove the need to fiddle with the `\thanks` and footnoting. They can be used like this:

```

\twocolumn[
\maketitle % full width title
\begin{oncolabstract} % full width abstract
... text
\end{oncolabstract}
]
\saythanks % typeset any \thanks

```

119 Really blank pages between chapters

Book (by default) and *report* (with `openright` class option) ensure that each chapter starts on a right-hand (recto) page; they do this by inserting a `\cleardoublepage` command between chapters (rather than a mere `\clearpage`). The empty page thus created gets to have a normal running header, which some people don't like.

The (excellent) *fancyhdr* manual covers this issue, basically advising the creation of a command `\clearempydoublepage`:

```

\let\origdoublepage\cleardoublepage
\newcommand{\clearempydoublepage}{%
\clearpage
\pagestyle{empty}\origdoublepage}%
}

```

The “obvious” thing is then to use this command to replace `\cleardoublepage` in a patched version of the `chapter` command. (Make a package of your own containing a copy of the command out of the class.) This isn't particularly difficult, but you can instead simply subvert `\cleardoublepage` (which isn't often used elsewhere):

```

\let\cleardoublepage\clearempydoublepage

```

Note: this command works because `\clearempydoublepage` uses a copy of `\cleardoublepage`: see question 190 for explanation.

Note that the *KOMA-Script* replacement for the *book* class (*scrbook*) offers class options that control the appearance of these empty pages, and Peter Wilson's *memoir* class has similar facilities.

memoir.cls: `macros/latex/contrib/supported/memoir`

scrbook.cls: Part of `macros/latex/contrib/supported/koma-script`

120 Balancing columns at the end of a document

The *twocolumn* option of the standard classes causes L^AT_EX to set the text of a document in two columns. However, the last page of the document typically ends up with columns of different lengths — such columns are said to be “unbalanced”. Many (most?) people don't like unbalanced columns.

The simplest solution to the problem is to use the *multicol* package in place of the *twocolumn* option, as *multicol* balances the columns on the final page by default. However, the use of *multicol* does come at a cost: its special output routine disallows the use of in-column floats, though it does still permit full-width (e.g., `figure*` environment) floats.

As a result, there is a constant push for a means of balancing columns at the end of a *twocolumn* document. Of course, the job can be done manually: `\pagebreak` inserted at the appropriate place on the last page can often produce the right effect, but this seldom appeals, and if the last page is made up of automatically-generated text (for example, bibliography or index) inserting the command will be difficult.

The *flushend* package offers a solution to this problem. It's a somewhat dangerous piece of macro code, which patches one of the most intricate parts of the L^AT_EX kernel without deploying any of the safeguards discussed in question 190. The package only changes the behaviour at end document (its `\flushend` command is enabled by default), and one other command permits adjustment of the final balance; other packages in the bundle provide means for insertion of full width material in two-column documents.

The *balance* package also patches the output routine (somewhat more carefully than *flushend*).

The user should be aware that any of these packages are liable to become confused in the presence of floats: if problems arise, manual adjustment of the floats in the document is likely to be necessary. It is this difficulty (what's required in any instance can't really be expressed in current L^AT_EX) that led the author of *multicol* to suppress single-column-wide floats.

balance.sty: Distributed as part of `macros/latex/contrib/other/preprint`

flushend.sty: Distributed as part of `macros/latex/contrib/supported/sttools`

multicol.sty: Distributed as part of `macros/latex/required/tools`

P.3 Page layout

121 How to get rid of page numbers

The package *nopageno* will suppress page numbers in a whole document.

To suppress page numbers from a single page, use `\thispagestyle{empty}` somewhere within the text of the page. (Note that `\maketitle` and `\chapter` both use `\thispagestyle` internally, so you need to call it after you've called them.)

To suppress page numbers from a sequence of pages, you may use `\pagestyle{empty}` at the start of the sequence, and restore the original page style at the end. Unfortunately, you still have to use `\thispagestyle` after any `\maketitle` or `\chapter` command.

An alternative is to use the rather delightful `\pagenumbering{gobble}`; this has the simple effect that any attempt to print a page number produces nothing, so there's no issue about preventing any part of \LaTeX from printing the number. However, the `\pagenumbering` command does have the side effect that it resets the page number (to 1), which may be undesirable.

nopageno: macros/latex/contrib/supported/
carlisle/nopageno.sty

122 `\pagestyle{empty}` on first page in \LaTeX

If you use `\pagestyle{empty}`, but the first page is numbered anyway, you are probably using the `\maketitle` command too. The behaviour is not a bug but a feature! The standard \LaTeX styles are written so that initial pages (pages containing a `\maketitle`, `\part`, or `\chapter`) have a different page style from the rest of the document; to achieve this, the commands internally issue `\thispagestyle{plain}`. This is usually not acceptable behaviour if the surrounding page style is 'empty'.

Possible workarounds include:

- Put `\thispagestyle{empty}` immediately after the `\maketitle` command, with no blank line between them.
- Use the *fancyhdr* package, which allows you to customise the style for initial pages independently of that for body pages.
- Use the *nopageno* package, which suppresses all page numbers by affecting the behaviour of page style commands.

fancyhdr.sty: macros/latex/contrib/supported/
fancyhdr

nopageno.sty: macros/latex/contrib/supported/
carlisle/nopageno.sty

123 How to create crop marks

If you're printing something that's eventually to be reproduced in significant quantities, and bound, it's conventional to print on paper larger than your target product, and to place "crop marks" outside the printed area. These crop marks are available to the production house, for lining up reproduction and trimming machines.

You can save yourself the (considerable) trouble of programming these marks for yourself by using the package *crop*, which has facilities to satisfy any conceivable production house.

crop.sty: macros/latex/contrib/supported/crop

124 'Watermarks' on every page

It's often useful to place some text (such as 'DRAFT') in the background of every page of a document. For \LaTeX users, this can be achieved with the *draftcopy* package. This can deal with many types of DVI processors (in the same way that the graphics package does) and knows translations for the word 'DRAFT' into a wide range of languages (though you can choose your own word, too).

More elaborate watermarks may be achieved using the *eso-pic* package, which in turn uses the package *everyshi*, both part of Martin Schröder's *ms* bundle.

draftcopy.sty: macros/latex/contrib/supported/
draftcopy

eso-pic.sty and *everyshi.sty*: Distributed in
macros/latex/contrib/supported/ms

125 Typesetting things in landscape orientation

It's often necessary to typeset part of a document in landscape orientation; to achieve this, one needs not only to change the page dimensions, but also to instruct the output device to print the strange page differently.

There are two "ordinary" mechanisms for doing two slight variations of landscape typesetting:

- If you have a single floating object that is wider than it is deep, and will only fit on the page in landscape orientation, use the *rotating* package; this defines `sidewaysfigure` and `sidewaystable` environments which create floats that occupy a whole page.
- If you have a long sequence of things that need to be typeset in landscape (perhaps a code listing, a wide `tabbing` environment, or a huge table typeset using *longtable* or *supertabular*), use the *lscap* package. This defines an environment `landscape`, which clears the current page and restarts typesetting in landscape orientation (and clears the page at the end of the environment before returning to portrait orientation).

No currently available package makes direct provision for typesetting in both portrait and landscape orientation on the same page (it's not the sort of thing that \TeX is well set-up to do). If such behaviour was an absolute necessity, one would use the techniques described in question 156, and would rotate the landscape portion using the rotation facilities of the *graphics* package. (Returning from landscape to portrait orientation would be somewhat easier: the portrait part of the page would be a bottom float at the end of the landscape section, with its content rotated.)

A word of warning: most current \TeX previewers do not honour rotation requests in `.dvi` files (the exceptions are the (commercial) Y&Y previewer *dviwindo* (see question 55), and the $\text{fp}\TeX$ previewer *WinDVI*). If your previewer is not capable of rotation, your best bet is to convert your output to PostScript or to PDF, and to view these 'final' forms with an appropriate viewer.

graphics.sty: Distributed as part of
macros/latex/required/graphics

longtable.sty: Distributed as part of
macros/latex/required/tools

lscap.sty: Distributed as part of
macros/latex/required/graphics

rotating.sty: macros/latex/contrib/supported/
rotating

supertabular.sty: macros/latex/contrib/
supported/supertabular

126 Putting things at fixed positions on the page

T_EX's model of the world is (broadly speaking) that the author writes text, and T_EX and its macros decide how it all fits on the page. This is not good news for the author who has, from whatever source, a requirement that certain things go in exactly the right place on the page.

Fortunately, in the L^AT_EX world at least, there *is* a fixed point on every page, to whit the page header. The package *textpos* latches bits of typesetting to locations you specify, by fixing them to the page header, and thereby solves the problem.

textpos.sty: macros/latex/contrib/supported/
textpos

P.4 Spacing of characters and lines

127 Double-spaced documents in L^AT_EX

Are you producing a thesis, and trying to obey regulations that were drafted in the typewriter era? Or are you producing copy for a journal that insists on double spacing for the submitted articles?

L^AT_EX is a typesetting system, so the appropriate design conventions are for “real books”. If your requirement is from thesis regulations, find whoever is responsible for the regulations, and try to get the wording changed to cater for typeset theses (*e.g.*, to say “if using a typesetting system, aim to make your thesis look like a well-designed book”). (If your requirement is from a journal, you're probably even less likely to be able to get the rules changed, of course.)

If you fail to convince your officials, or want some inter-line space for copy-editing, try changing `\baselinestretch`: `\renewcommand{\baselinestretch}{1.2}` may be enough to give officials the impression you've kept to their regulations; `\baselinestretch` changes don't take effect until you select a new font, so make the change in the preamble before any font is selected. Don't try changing `\baselineskip`: its value is reset at any size-changing command.

Alternatively, use a line-spacing package; the only one currently supported is *setspace* (do *not* be tempted by *doubleSPACE*: its performance under current L^AT_EX is at best problematical). *setspace* has the advantage that it switches off double-spacing at places where you would want it to (footnotes, figure captions, and so on); it's very troublesome to achieve this if you're manipulating `\baselinestretch` yourself.

setspace.sty: macros/latex/contrib/supported/
setspace/setspace.sty

128 Changing the space between letters

A common technique in advertising copy (and other text whose actual content need not actually be *read*) is to alter the space between the letters (otherwise known as the tracking). As a general rule, this is a very bad idea: it detracts from legibility, which is contrary to the principles of typesetting (any respectable font you might be using should already have optimum tracking built into it).

The great type designer, Eric Gill, is credited with saying “he who would letterspace lower-case text, would steal sheep”. (The attribution is probably apocryphal: others are also credited with the remark. Stealing sheep was, in the 19th century, a capital offence in Britain.) As the remark suggests, though, letterspacing of upper-case text is less awful a crime; the technique used also to be used for emphasis of text set in Fraktur (or similar) fonts.

Straightforward macros (usable, in principle, with any T_EX macro package) may be found in *letterspacing* (which is the name of the `.tex` file; it also appears as the *letterspace* package in some distributions).

The *tracking* package has similar facilities.

A more comprehensive solution is to be found in the *soul* package (which is optimised for use with L^AT_EX, but also works with Plain T_EX). *Soul* also permits hyphenation of letterspaced text; Gill's view of such an activity is not (even apocryphally) recorded. (Spacing-out forms part of the name of *soul*; the other half is described in question 205.)

letterspacing.tex: macros/generic/
letterspacing.tex

soul.sty: macros/latex/contrib/supported/soul

tracking.sty: macros/latex/contrib/supported/
tracking/tracking.sty

129 Setting text ragged right

The trick with typesetting ragged right is to be sure you've told the T_EX engine “make this paragraph ragged, but never *too* ragged”. The L^AT_EX `\raggedright` command (and the corresponding `flushleft` environment) has a tendency to miss the “never” part, and will often create ridiculously short lines, for some minor benefit later in the paragraph. The Plain T_EX version of the command doesn't suffer this failing, but is rather conservative: it is loath to create too large a gap at the end of the line, but in some circumstances (such as where hyphenation is suppressed see question 175) painfully large gaps may sometimes be required.

Martin Schröder's *ragged2e* package offers the best of both worlds: it provides raggedness which is built on the Plain T_EX model, but which is easily configurable. It defines easily-remembered command (*e.g.*, `\RaggedRight`) and environment (*e.g.*, `FlushLeft`) names that are simply capitalised transformations of the L^AT_EX kernel originals. The documentation discusses the issues and explains the significance of the various parameters of *ragged2e*'s operation.

ragged2e.sty: Distributed as part of
macros/latex/contrib/supported/ms

130 Cancelling \ragged commands

L^AT_EX provides commands `\raggedright` and `\raggedleft`, but none to cancel their effect.

The following code (to be inserted in a package of your own, or as internal L^AT_EX code —see question 191) defines a command that restores flush justification at both margins:

```
\def\flushboth{%
  \let\\\@normalcr
  \@rightskip\z@skip \rightskip\@rightskip
  \leftskip\z@skip
  \parindent 1.5em\relax}
```

There's a problem with the setting of `\parindent` in the code: it's necessary because both the `\ragged` commands set `\parindent` to zero, but the setting isn't a constant of nature: documents using a standard L^AT_EX class with `twocolumn` option will have 1.0em by default, and there's no knowing what you (or some other class) will have done.

P.5 Typesetting specialities

131 Including a file in verbatim in L^AT_EX

A good way is to use Rainer Schöpf's *verbatim*, which provides a command `\verbatiminput` that takes a file name as argument.

Another way is to use the `alltt` environment, which requires *alltt*. `alltt` interprets its contents 'mostly' verbatim, but executes any T_EX commands it finds: so one can say:

```
\begin{alltt}
\input{verb.txt}
\end{alltt}
```

of course, this is little use for inputting (L^A)T_EX source code...

Moreverb extends the facilities of *verbatim* package, providing a `listing` environment and a `\listinginput` command, which line-number the text of the file. The package also has a `\verbatimtabinput` command, that honours TAB characters in the input (the `listing` environment and command also both honour TAB).

The *fancyvrb* package offers configurable implementations of everything *verbatim* and *moreverb* have, and more besides. It is nowadays the package of choice for the discerning typesetter of verbatim text, but its wealth of facilities makes it a complex beast and study of the documentation is strongly advised.

alltt.sty: Part of the L^AT_EX distribution.

fancyvrb.sty: macros/latex/contrib/supported/
fancyvrb

moreverb.sty: macros/latex/contrib/supported/
moreverb

verbatim.sty: Distributed as part of
macros/latex/required/tools

132 Including line numbers in typeset output

For general numbering of lines, there are two packages for use with L^AT_EX, *lineno* (which permits labels attached to individual lines of typeset output) and *numline*.

Both of these packages play fast and loose with the L^AT_EX output routine, which can cause problems: the user should beware...

If the requirement is for numbering verbatim text, *moreverb* or *fancyvrb* (see question 131) may be used.

One common use of line numbers is in critical editions of texts, and for this the *edmac* package (macros/plain/contrib/edmac) offers comprehensive support.

fancyvrb.sty: macros/latex/contrib/supported/
fancyvrb

lineno.sty: macros/latex/contrib/supported/
lineno

moreverb.sty: macros/latex/contrib/supported/
moreverb

numline.sty: macros/latex/contrib/supported/
numline/numline.sty

133 Generating an index in (L^A)T_EX

Making an index is not trivial; what to index, and how to index it, is difficult to decide, and uniform implementation is difficult to achieve. You will need to mark all items to be indexed in your text (typically with `\index` commands).

It is not practical to sort a large index within T_EX, so a post-processing program is used to sort the output of one T_EX run, to be included into the document at the next run.

The following programs are available:

makeindex Comes with most distributions — a good workhorse, but is not well-arranged to deal with other sort orders than the canonical ASCII ordering.

The *makeindex* documentation is a good source of information on how to create your own index. *Makeindex* can be used with some T_EX macro packages other than L^AT_EX, such as Eplain (see question 14), and T_EXsis (whose macros can be used independently with Plain T_EX).

idxTeX for L^AT_EX under VMS, which comes with a glossary-maker called *glotex*.

texindex A witty little shell/*sed*-script-based utility for L^AT_EX under Unix.

There are other programs called *texindex*, notably one that comes with the Texinfo distribution (see question 16).

xindy arose from frustration at the difficulty of making a multi-language version of *makeindex*. It is designed to be a successor to *makeindex*, by a team that included the then-current maintainer of *makeindex*. It successfully addresses many of *makeindex*'s shortcomings, including difficulties with collation order in different languages, and it is highly flexible. Sadly, its take-up is proving rather slow.

idxTeX: indexing/glo+idxTeX

makeindex: indexing/makeindex

makeindex (Macintosh):

systems/mac/macmakeindex2.12.sea.hqx

texindex: support/texindex

texsis (system): macros/texsis
texsis (makeindex support):
 macros/texsis/index/index.tex
windy: support/xindy

134 Typesetting URLs

URLs tend to be very long, and contain characters that would naturally prevent them being hyphenated even if they weren't typically set in `\ttfamily`, verbatim. Therefore, without special treatment, they often produce wildly overfull `\hboxes`, and their typeset representation is awful.

There are three packages that help solve this problem:

- The *Path* package, which defines a `\path` command. The command defines each potential break character as a `\discretionary`, and offers the user the opportunity of specifying a personal list of potential break characters. Its chief disadvantage is fragility in \LaTeX moving arguments. (The Eplain macros — see question 14 — define a similar `\path` command.)
- The *url* package, which defines an `\url` command (among others, including its own `\path` command). The command gives each potential break character a maths-mode ‘personality’, and then sets the URL itself (in the user’s choice of font) in maths mode. It can produce (\LaTeX -style) ‘robust’ commands (see question 192) for use within moving arguments. Note that, because the operation is conducted in maths mode, spaces within the URL argument are ignored unless special steps are taken. It is possible to use the *url* package in Plain \TeX , with the assistance of the *miniltx* package (which was originally developed for using the \LaTeX graphics package in Plain \TeX). A small patch is also necessary: the required sequence is therefore:

```
\input miniltx
\expandafter\def\expandafter\+%
                \expandafter{\+}

\input url.sty
```

- The *hyperref* package, which uses the typesetting code of *url*, in a context where the typeset text forms the anchor of a link.

The author of this answer prefers the (rather newer) *url* package (directly or indirectly); both *path* and *url* work well with Plain \TeX (though of course, the fancy \LaTeX facilities of *url* don't have much place there). (*hyperref* isn't available in a version for use with Plain \TeX .)

hyperref.sty: macros/latex/contrib/supported/hyperref

miniltx.tex: Distributed as part of
 macros/plain/graphics

path.sty: macros/latex/contrib/other/misc/path.sty

url.sty: macros/latex/contrib/other/misc/url.sty

135 Typesetting music in \TeX

In the early days, a simple music package called *mutex* was written by Angelika Schofer and Andrea Steinbach, which demonstrated that music typesetting was possible; the package was very limited, and is no longer available. Daniel Taupin took up the baton, and developed *Music \TeX* , which allows the typesetting of polyphonic and other multiple-stave music; *Music \TeX* remains available, but is most definitely no longer recommended.

Music \TeX has been superseded by its successor *MusiX \TeX* , which is a three-pass system (with a processor program that computes values for the element spacing in the music), and achieves finer control than is possible in the unmodified \TeX -based mechanism that *Music \TeX* uses. Daniel Taupin's is the only version of *MusiX \TeX* currently being developed (the original author, Andreas Egler, had an alternative version, but he is now working on a different package altogether).

Input to *MusiX \TeX* is extremely tricky stuff, and Don Simons' preprocessor *pmx* is the preferred method of creating input for Taupin's version. *Pmx* greatly eases use of *MusiX \TeX* , but it doesn't support the full range of *MusiX \TeX* 's facilities directly; however, it does allow inline *MusiX \TeX* code in *pmx* sources.

Dirk Laurie's *M-Tx* allows preparation of music with lyrics; it operates “on top of” *pmx*

Another simple notation is supported by *abc2mtex*; this is a package designed to notate tunes stored in an ASCII format (*abc* notation). It was designed primarily for folk and traditional tunes of Western European origin (such as Irish, English and Scottish) which can be written on one stave in standard classical notation, and creates input intended for *Music \TeX* . However, it should be extendable to many other types of music.

Digital music fans can typeset notation for their efforts by using *midi2tex*, which translates MIDI data files into *Music \TeX* source code.

There is a mailing list (TeX-music@sunsite.dk) for discussion of typesetting music in \TeX . To subscribe, use <http://sunsite.dk/mailman/listinfo/tex-music/>

abc2mtex: support/abc2mtex

M-Tx: support/mtx

midi2tex: support/midi2tex

musictex: macros/musictex

musixtex (Taupin's version):
 macros/musixtex/taupin

musixtex (Egler's version):
 macros/musixtex/egler

pmx: support/pmx

136 Other “document font” sizes?

The \LaTeX standard classes have a concept of a (base) “document font” size; this size is the basis on which other font sizes (those from `\tiny` to `\Huge`) are determined. The classes are designed on the assumption that they won't be used with sizes other than the set that \LaTeX offers by default (10–12pt), but people regularly find they

need other sizes. The proper response to such a requirement is to produce a new design for the document, but many people don't fancy doing that.

Pragmatists, therefore, will tend to go for the classes in the *extsizes* bundle. This bundle offers “extended” versions of the article, report, book and letter classes, at sizes of 8, 9, 14, 17 and 20pt as well as the standard 10–12pt. Since little has been done to these classes other than to adjust font sizes and things directly related to them, they won't be optimal — but they're certainly practical.

```
extsizes bundle: macros/latex/contrib/other/
extsizes
```

137 Zero paragraph indent

The conventional way of typesetting running text has no separation between paragraphs, and the first line of each paragraph in a block of text indented.

In contrast, one common convention for typewritten text was to have no indentation of paragraphs; such a style is often required for “brutalist” publications such as technical manuals, and in styles that hanker after typewritten manuscripts, such as officially-specified dissertation formats.

Anyone can see, after no more than a moment's thought, that if the paragraph indent is zero, the paragraphs must be separated by blank space: otherwise it is sometimes going to be impossible to see the breaks between paragraphs.

The simple-minded approach to zero paragraph indentation is thus:

```
\setlength{\parindent}{0pt}
\setlength{\parskip}{\baselineskip}
```

and in the very simplest text, it's a fine solution.

However, the non-zero `\parskip` interferes with lists and the like, and the result looks pretty awful. The *parskip* package patches things up to look reasonable; it's not perfect, but it deals with most problems.

The Netherlands Users' Group's set of classes includes an *article* equivalent (*artikel3*) and a *report* equivalent (*rapport3*) whose design incorporates zero paragraph indent and non-zero paragraph skip.

```
NTG classes: macros/latex/contrib/supported/
ntgclass
```

```
parskip.sty: macros/latex/contrib/other/misc/
parskip.sty
```

138 Set specifications and Dirac brackets

One of the few glaring omissions from \TeX 's mathematical typesetting capabilities is a means of setting separators in the middle of mathematical expressions. \TeX provides primitives called `\left` and `\right`, which can be used to modify brackets (of whatever sort) around a mathematical expression, as in: `\left(<expression> \right)` — the size of the parentheses is matched to the vertical extent of the expression.

However, in all sorts of mathematical enterprises one may find oneself needing a `\middle` command, to be used in expressions like

```
\left{\ x\in N \middle| x\mbox{ even} \right\}
```

to specify the set of even natural numbers. The $\varepsilon\text{-}\TeX$ system (see question 237) defines just such a command, but users of Knuth's original need some support. Donald Arseneau's *braket* package provides commands for set specifications (as above) and for Dirac brackets (and bras and kets). The package uses the $\varepsilon\text{-}\TeX$ built-in command if it finds itself running under $\varepsilon\text{-}\TeX$.

```
braket.sty: macros/latex/contrib/other/misc/
braket.sty
```

139 Big letters at the start of a paragraph

A common style of typesetting, now seldom seen except in newspapers, is to start a paragraph (in books, usually the first of a chapter) with its first letter set large enough to span several lines.

This style is known as “dropped capitals”, or (in French) “lettrines”, and \TeX 's primitive facilities for hanging indentation make its (simple) implementation pretty straightforward.

The *dropping* package does the job simply, but has a curious attitude to the calculation of the size of the font to be used for the big letters. Examples appear in the package documentation, so before you process the `.dtx`, the package itself must already be installed.

The *lettrine* package has a well-constructed array of options, and the examples (a pretty impressive set) come as a separate file (also distributed in PostScript, so that they can be viewed without installing the package itself).

```
dropping: macros/latex/contrib/other/dropping
```

```
lettrine: macros/latex/contrib/supported/
lettrine
```

140 Code listings in \LaTeX

‘Pretty’ code listings are sometimes considered worthwhile by the neurotically aesthetic programmer, but they have a serious place in the typesetting of dissertations by computer science and other students who are expected to write programs. Simple verbatim listings are commonly useful, as well.

Verbatim listings are dealt with elsewhere (see question 131). ‘Pretty’ listings are generally provided by means of a pre-compiler, but the *listings* package manages to do the job within \LaTeX .

The *lgrind* system is a well-established pre-compiler, with all the facilities one might need and a wide repertoire of languages.

The *tiny-c2l* system is more recent: users are encouraged to generate their own driver files for languages it doesn't already deal with.

The *C++2LaTeX* system comes with strong recommendations for use with C and C++.

```
C++2LaTeX: support/C++2LaTeX-1_1p11
```

```
lgrind: support/lgrind
```

```
listings.sty: macros/latex/contrib/supported/
listings
```

```
tiny-c2l: support/tiny_c2l
```

141 The comma as a decimal separator

If you use a comma in maths mode, you get a small space after it; this space is inappropriate if the comma is being used as a decimal separator. An easy solution to this problem is to type (in math mode) `3{,}14` instead of typing `3,14`. However, if your language’s typographic rules require the comma as a decimal separator, such usage can rapidly become extremely tiresome. In such cases it is probably better to use the *icomma* package. The package ensures that there will be no extra space after a comma, unless you type a space after it (as in `f(x, y)`, for instance), in which case the usual small space after the comma appears.

icomma.sty: Distributed as part of
macros/latex/contrib/supported/was

142 Breaking boxes of text

(L^AT_EX) boxes may not be broken, in ordinary usage: once you’ve typeset something into a box, it will stay there, and the box will jut out beyond the side or the bottom of the page if it doesn’t fit in the typeset area.

If you want a substantial portion of your text to be framed (or coloured), the restriction starts to seem a real imposition. Fortunately, there are ways around the problem.

The *framed* package provides `framed` and `shaded` environments; both put their content into something which looks like a framed (or coloured) box, but which breaks as necessary at page end. The environments “lose” footnotes, marginpars and head-line entries, and will not work with *multicol* or other column-balancing macros.

The *boites* package provides a `breakbox` environment; examples of its use may be found in the distribution, and the package’s `README` file contains terse documentation. The environments may be nested, and may appear inside `multicols` environments; however, floats, footnotes and marginpars will be lost.

For Plain T_EX users, the facilities of the *backgrnd* package may be useful; this package subverts the output routine to provide vertical bars to mark text, and the macros are clearly marked to show where coloured backgrounds may be introduced (this requires *shade*, which is distributed as tex macros and device-independent META-FONT for the shading). The author of *backgrnd* claims that the package works with L^AT_EX 2.09, but there are reasons to suspect that it may be unstable working with current L^AT_EX.

backgrnd.tex: macros/generic/backgrnd.tex
boites.sty: macros/latex/contrib/other/boites
framed.sty: macros/latex/contrib/other/misc/
framed.sty
shade.tex: macros/generic/shade.sty

P.6 Tables of contents and indexes

143 The format of the Table of Contents, etc.

The formats of entries in the table of contents (TOC) are controlled by a number of internal commands (discussed in section 2.4 of *The L^AT_EX Companion* — see question 22). The commands `\@pnumwidth`, `\@tocrmarg`

and `\@dotsep` control the space for page numbers, the indentation of the right-hand margin, and the separation of the dots in the dotted leaders, respectively. The series of commands named `\l@xxx`, where `xxx` is the name of a sectional heading (such as `chapter` or `section`, ...) control the layout of the corresponding heading, including the space for section numbers. All these internal commands may be individually redefined to give the effect that you want.

Alternatively, the package *tocloft* provides a set of user-level commands that may be used to change the TOC formatting. Since exactly the same mechanisms are used for the List of Figures and List of Tables, the layout of these sections may be controlled in the same way.

tocloft.sty: macros/latex/contrib/supported/
tocloft

144 Unnumbered sections in the Table of Contents

The easiest way to get headings of funny ‘sections’ such as prefaces in the table of contents is to use the counter `secnumdepth` described in Appendix C of the L^AT_EX manual. For example:

```
\setcounter{secnumdepth}{-1}  
\chapter{Preface}
```

Of course, you have to set `secnumdepth` back to its usual value (which is 2 in the standard styles) before you do any ‘section’ which you want to be numbered.

Similar settings are made automatically in the L^AT_EX book class by the `\frontmatter` and `\backmatter` commands.

This is why it works: `\chapter` without the star does

1. put something in the `.toc` file;
2. if `secnumdepth` ≥ 0 , increase the counter for the chapter and write it out.
3. write the chapter title.

Other sectioning commands are similar, but with other values used in the test.

The value of the counter `tocdepth` controls which headings will be finally printed in the table of contents. This normally has to be set in the preamble and is a constant for the document. The package *tocvsec2* package provides a convenient interface to allow you to change the `secnumdepth` and/or the `tocdepth` counter values at any point in the body of the document; this provides convenient independent controls over the sectional numbering and the table of contents.

The package *abstract* (see question 118) includes an option to add the `abstract` to the table of contents, while the package *tocbibind* has options to include the table of contents itself, the `bibliography`, `index`, etc., to the table of contents.

abstract.sty: macros/latex/contrib/supported/
abstract
tocbibind.sty: macros/latex/contrib/supported/
tocbibind
tocvsec2.sty: macros/latex/contrib/supported/
tocvsec2

145 Bibliography, index, etc., in TOC

For “how to do” (I suppose)

The standard L^AT_EX classes (and many others) use `\section*` or `\chapter*` for auto-generated parts of the document (the tables of contents, figures and tables, the bibliography and the index). As a result, these items aren’t numbered (which most people don’t mind), and (more importantly) they don’t appear in the table of contents.

The correct solution (as always) is to have a class of your own that formats your document according to your requirements. The macro to do the job (`\addcontentsline`) is fairly simple, but there is always an issue of ensuring that the contents entry quotes the correct page:

```
\bibliography{frooble}
\addcontentsline{toc}{chapter}{Bibliography}
```

will produce the *wrong* answer if the bibliography is more than one page long. Instead, one should say:

```
\cleardoublepage
\addcontentsline{toc}{chapter}{Bibliography}
\bibliography{frooble}
```

(Note that `\cleardoublepage` does the right thing, even if your document is single-sided — in that case, it’s a synonym for `\clearpage`). Ensuring that the entry refers to the right place is trickier still in a `\section`-based class.

The common solution, therefore, is to use the *tocbibind* package, which provides many facilities to control the way these entries appear in the table of contents.

Of course, the *KOMA-Script* bundle of classes (*scrbook* instead of *book*, *scrreprt* instead of *report*, etc.) provide this functionality as a set of class options.

KOMA-Script bundle: `macros/latex/contrib/supported/koma-script`

tocbibind.sty: `macros/latex/contrib/supported/tocbibind`

146 Multiple indexes

L^AT_EX’s standard indexing capabilities (those provided by the *makeidx* package) only provide for one index in your document; even quite modest documents can be improved by indexes for separate topics.

The *multind* package provides simple and straightforward multiple indexing. You tag each `\makeindex`, `\index` and `\printindex` command with a file name, and indexing commands are written to (or read from) the name with the appropriate (`.idx` or `.ind`) extension appended. The `\printindex` command is modified from the L^AT_EX standard so that it doesn’t create its own chapter or section heading; you therefore decide what names (or sectioning level, even) to use for the indexes, and `\indexname` (see question 187) is completely ignored.

The *index* package provides a comprehensive set of indexing facilities, including a `\newindex` command that allows the definition of new styles of index. `\newindex` takes a ‘tag’ (for use in indexing commands), replacements for the `.idx` and `.ind` file extensions, and a title for the index when it’s finally printed; it can also change the item that’s being indexed against (for example, one

might have an index of artists referenced by the figure number where their work is shown).

index.sty: Distributed as part of
`macros/latex/contrib/supported/camel`

multind.sty: `macros/latex209/contrib/misc/multind.sty`

Q How do I do X in (L^A)T_EX

Q.1 Mathematics

147 Proof environment

It has long been thought impossible to make a proof environment which automatically includes an ‘end-of-proof’ symbol. Some proofs end in displayed maths; others do not. If the input file contains `... \] \end{proof}` then L^AT_EX finishes off the displayed maths and gets ready for a new line before it reads any instructions connected with ending the proof, so the code is very tricky. You *can* insert the symbol by hand, but the *ntheorem* package now solves the problem for L^AT_EX users: it does indeed provide an automatic way of signalling the end of a proof.

ntheorem: `macros/latex/contrib/supported/ntheorem`

148 Roman theorems

If you want to take advantage of the powerful `\newtheorem` command without the constraint that the contents of the theorem is in a sloped font (for example, to use it to create remarks, examples, proofs, ...) then you can use the *theorem* package. Alternatively, the following sets up an environment `remark` whose content is in roman.

```
\newtheorem{preremark}{Remark}
\newenvironment{remark}%
{\begin{preremark}\upshape}{\end{preremark}}
```

The *ntheorem* package provides roman theorems directly.

ntheorem.sty: `macros/latex/contrib/supported/ntheorem`

theorem.sty: Distributed as part of
`macros/latex/required/tools`

149 Defining a new log-like function in L^AT_EX

Use the `\mathop` command, as in:

```
\newcommand{\diag}{\mathop{\mathrm{diag}}}
```

Subscripts and superscripts on `\diag` will be placed as they are on `\lim`. If you want your subscripts and superscripts always placed to the right, do:

```
\newcommand{\diag}{\mathop{\mathrm{diag}}\nolimits}
```

A_MS-L^AT_EX provides a command `\DeclareMathOperator` (in its *amsopn* package) that satisfies the requirement.

(It should be noted that “log-like” was reportedly a *joke* on Lamport’s part; it is of course clear what was meant.)

amsopn.sty: In the *A_MS-L^AT_EX* distribution
`macros/latex/required/amslatex`

Q.2 Lists

150 Fancy enumeration lists

Suppose you want your top-level `enumerates` to be labelled ‘I’, ‘II’, ..., then give these commands:

```
\renewcommand{\theenumi}{\Roman{enumi}}
\renewcommand{\labelenumi}{\theenumi/}
```

The possible styles of numbering are given in Section 6.3 of Lamport’s book (see question 22). Both `\theenumi` and `\labelenumi` must be changed, since `\theenumi` is used in cross-references to the list.

For lower level `enumerates`, replace `enumi` by `enumii`, `enumiii` or `enumiv`, according to the level. If your label is much larger than the default, you should also change `\leftmargini`, `\leftmarginii`, *etc.*

If you’re running $\LaTeX 2_{\epsilon}$, the `enumerate.sty` package offers similar facilities. Using it, the example above would be achieved simply by starting the enumeration `\begin{enumerate}[I/]`.

enumerate.sty: Distributed as part of
macros/latex/required/tools

151 How to reduce list spacing

Lamport’s book (see question 22) lists various parameters for the layout of list (things like `\topsep`, `\itemsep` and `\parsep`), but fails to mention that they’re set automatically within the list itself. It works by each list executes a command `\@list<depth>` (the depth appearing as a lower-case roman numeral); what’s more, `\@listi` is usually reset when the font size is changed. As a result, it’s rather tricky for the user to control list spacing; of course, the real answer is to use a document class designed with more modest list spacing, but we all know such things are hard to come by.

There are packages that provide some control of list spacing, but they seldom address the separation from surrounding text (defined by `\topsep`). The `expdlist` package, among its many controls of the appearance of `description` lists, offers a compaction parameter (see the documentation); the `mdwlist` package offers a `\makecompactlist` command for users’ own list definitions, and uses it to define compact lists `itemize*`, `enumerate*` and `description*`. In fact, you can write lists such as these commands define pretty straightforwardly — for example:

```
\newenvironment{itemize*}%
{\begin{itemize}%
\setlength{\itemsep}{0pt}%
\setlength{\parsep}{0pt}}%
{\end{itemize}}
```

However, both packages offer other facilities for list configuration: you should certainly not try the “do-it-yourself” approach if you need a package for some other list configuration purpose.

If you want to adjust `\topsep`, the most sensible approach (at present) is to define your list ‘from first principles’ using the `\list` command; its invocation is `\list<item stuff>{<list stuff>}`; the `<list stuff>` is executed *after* the `\@list<depth>`, and can therefore be used to adjust all the parameters, including `\topsep`.

An alternative is to redefine `\@list<depth>` (and the size-changing commands that alter `\@listi`), but this is not recommended unless you’re building your own class or package, in which case one hopes you’re capable of analysing the way in which the standard classes do things (as recommended in question 28).

expdlist.sty: macros/latex/contrib/supported/expdlist

mdwlist.sty: Distributed as part of
macros/latex/contrib/supported/mdwtools

Q.3 Tables, figures and diagrams

152 Fixed-width tables

There are two basic techniques for making fixed-width tables in \LaTeX : you can make the gaps between the columns stretch, or you can stretch particular cells in the table.

Basic \LaTeX can make the gaps stretch: the `tabular*` environment takes an extra argument (before the `clpr` layout one) which takes a length specification: you can say things like “15cm” or “\columnwidth” here. You must also have an `\extracolsep` command in the `clpr` layout argument, inside an `@{}` directive. So, for example, one might have

```
\begin{tabular*}{\columnwidth}%
@{\extracolsep{\fill}}{lllr}
```

The `\extracolsep` applies to all inter-column gaps to its right as well; if you don’t want all gaps stretched, add `\extracolsep{0pt}` to cancel the original.

The `tabularx` package defines an extra `clpr` directive, `X`; `X` columns behave as `p` columns which expand to fill the space available. If there’s more than one `X` column in a table, the spare space is distributed between them.

The `ltxtable` combines the features of the `longtable` and `tabularx` packages: it’s important to read the documentation, since usage is distinctly odd.

ltxtable.sty: Distributed as part of
macros/latex/contrib/supported/carlsisle

tabularx.sty: Distributed as part of
macros/latex/required/tools

153 Spacing lines in tables

*For “how to do”
(or a new one on tables?)*

(\LaTeX) mechanisms for maintaining the space between lines (the “*leading*”) rely on \TeX ’s paragraph builder, which compares the shape of consecutive lines and adjusts the space between them.

These mechanisms can’t work in exactly the same way when \LaTeX is building a table, because the paragraph builder doesn’t get to see the lines themselves. As a result, tables sometimes typeset with lines uncomfortably close together (or occasionally ridiculously far apart).

Traditional (moving metal type) typographers would adjust the spacing between lines of a table by use of a “*strut*” (a metal spacer). A \TeX user can do exactly the same thing: most macro packages define a `\strut` command, that defines a space appropriate to the current size of the text; placing a `\strut` command at the end of a

troublesome row is the simplest solution to the problem — if it works. Other solutions below are L^AT_EX-specific, but some may be simply translated to Plain T_EX commands.

If your table exhibits a systematic problem (i.e., every row is wrong by the same amount) use `\extrarowheight`, which is defined by the *array* package:

```
\usepackage{array}% in the preamble
...
\setlength{\extrarowheight}{length}
\begin{tabular}{...}
```

To correct a single row whose maladjustment isn't corrected by a `\strut` command, you can define your own, using `\rule{0pt}{length}` — which is a near approximation to the command that goes inside a `\strut`.

General solutions are available, however. The *tabs* package automatically generates an appropriately-sized strut at the end of each row. Its disadvantages are that it's really rather slow in operation (since it gets in the way of everything within tables) and its (lack of) compatibility with other packages.

The *booktabs* package comes with a thought-provoking essay about how tables should be designed. Since table row-spacing problems most often appear in collisions with rules, the author's thesis, that L^AT_EX users tend too often to rule their tables, is interesting. The package provides rule commands to support the author's scheme, but deals with inter-row spacing too. Again, *booktabs* is not compatible with some other packages.

array.sty: Distributed as part of
macros/latex/required/tools

booktabs.sty: macros/latex/contrib/supported/
booktabs

tabs.sty: macros/latex/contrib/other/misc/
tabs.sty

154 Tables longer than a single page

*For "how to do"
or a new section on tables*

Tables are, by default, set entirely in boxes of their own: as a result, they won't split over a page boundary. Sadly, the world keeps turning up tables longer than a single page that we need to typeset.

For simple tables (whose shape is highly regular), the simplest solution may well be to use the `tabbing` environment, which is tedious to set up, but which doesn't force the whole alignment onto a single page.

The *longtable* package builds the whole table (in chunks), in a first pass, and then uses information it has written to the `.aux` file during later passes to get the setting "right" (the package ordinarily manages to set tables in just two passes). Since the package has overview of the whole table at the time it's doing "final" setting, the table is set "uniformly" over its entire length, with columns matching on consecutive pages. *longtable* has a reputation for failing to interwork with other packages, but it does work with *colortbl*, and its author has provided the *ltxtable* package to provide (most of) the facilities of *tabularx* (see question 152) for long tables: beware of its rather curious usage constraints — each long table should be in a file of its own, and included by `\LTXtable`

`{width}{file}`. Since *longtable*'s multiple-page tables can't possibly live inside floats, the package provides for captions within the `longtable` environment itself.

The *supertabular* package starts and stops a `tabular` environment for each page of the table. As a result, each 'page worth' of the table is compiled independently, and the widths of corresponding columns may differ on successive pages. However, if the correspondence doesn't matter, or if your columns are fixed-width, *supertabular* has the great advantage of doing its job in a single run.

Both *longtable* and *supertabular* allow definition of head- and footlines for the table; *longtable* allows distinction of the first and last head and foot.

The *xtab* package fixes some infelicities of *supertabular*, and also provides a "last head" facility (though this, of course, destroys *supertabular*'s advantage of operating in a single run).

longtable.sty: Distributed as part of
macros/latex/required/tools

ltxtable.sty: Generate by running macros/latex/
contrib/supported/carlisle/ltxtable.tex

supertabular.sty: macros/latex/contrib/
supported/supertabular

xtab.sty: macros/latex/contrib/supported/xtab

155 How to alter the alignment of tabular cells

One often needs to alter the alignment of a `tabular` p ('paragraph') cell, but problems at the end of a table row are common. If we have a p cell that looks like

```
... & \centering blah ... \\\
```

one is liable to encounter errors that complain about a "misplaced `\noalign`" (or the like). The problem is that the command `\\` means different things in different circumstances: the `tabular` environment switches the meaning to a value for use in the table, and `\centering`, `\flushright` and `\flushleft` all change the meaning to something incompatible. Note that the problem only arises in the last cell of a row: since each cell is set into a box, its settings are lost at the `&` (or `\\`) that terminates it.

The simple (old) solution is to preserve the meaning of `\\`:

```
\def\PBS#1{\let\temp=\\%
#1%
\let\\=\temp
}
```

which one uses as:

```
... & \PBS\centering blah ... \\\
```

(for example).

The technique using `\PBS` was developed in the days of L^AT_EX 2.09 because the actual value of `\\` that the `tabular` environment used was only available as an internal command. Nowadays, the value is a public command, and you can in principle use it explicitly:

```
... & \centering blah ... \tabularnewline
```

but the old trick has the advantage of extreme compactness.

The `\PBS` trick also serves well in *array* package "field format" preamble specifications:

```
\begin{tabular}{... >{\PBS\centering}p{50mm}}
...
```

array.sty: Distributed as part of
macros/latex/required/tools

156 Flowing text around figures in L^AT_EX

There are several L^AT_EX packages that purport to do this, but they all have their limitations because the T_EX machine isn't really designed to solve this sort of problem. Piet van Oostrum has conducted a survey of the available packages; he recommends:

`floatflt` *floatflt* is an improved version (for L^AT_EX 2_ε) of `floatfig.sty`, and its syntax is:

```
\begin{floatingfigure}[options]{width of figure}
```

```
figure contents
```

```
\end{floatingfigure}
```

There is a (more or less similar) `floatingtable` environment.

The tables or figures can be set left or right, or alternating on even/odd pages in a double-sided document.

The package works with the `multicol` package, but doesn't work well in the neighbourhood of list environments (unless you change your L^AT_EX document).

`wrapfig` *wrapfig* has syntax:

```
\begin{wrapfigure}[height of figure in lines]
{1,r,etc}[overhang]{width}
```

```
figure, caption, etc.
```

```
\end{wrapfigure}
```

The syntax of the `wratable` environment is similar.

Height can be omitted, in which case it will be calculated by the package; the package will use the greater of the specified and the actual width. The `{1,r,etc.}` parameter can also be specified as `i` (*n*side) or `o` (*u*tside) for two-sided documents, and uppercase can be used to indicate that the picture should float. The overhang allows the figure to be moved into the margin. The figure or table will enter into the list of figures or tables if you use the `\caption` command.

The environments do not work within list environments that end before the figure or table has finished, but can be used in a `parbox` or `minipage`, and in `twocolumn` format.

`picins` *Picins* is part of a large bundle that allows inclusion of pictures (e.g., with shadow boxes, various MS-DOS formats, etc.). The command is:

```
\parpic(width,height)(x-off,y-off)
```

```
[Options][Position]
```

```
{Picture}
```

Paragraph text

All parameters except the *Picture* are optional. The picture can be positioned left or right, boxed with a rectangle, oval, shadowbox, dashed box, and a caption can be given which will be included in the list of figures.

Unfortunately (for those of us whose understanding

of German is not good), the documentation is in German. Piet van Oostrum has written an English summary.

floatflt.sty: macros/latex/contrib/other/
floatflt

picins.sty: systems/msdos/picins/picins.zip

picins documentation summary:

```
macros/latex209/contrib/picins/picins.txt
```

wrapfig.sty: macros/latex/contrib/other/misc/
wrapfig.sty

157 Drawing with T_EX

There are many packages to do pictures in (L^A)T_EX itself (rather than importing graphics created externally), ranging from simple use of L^AT_EX `picture` environment, through enhancements like *epic*, to sophisticated (but slow) drawing with P_lCT_EX. Depending on your type of drawing, and setup, four systems should be at the top of your list to look at:

1. *pstricks*; this gives you access to all the power of PostScript from T_EX itself, by sophisticated use of `\specials`. You need a decent DVI to PostScript driver (like *dvips*), but the results are worth it. The well-documented package gives you not only low-level drawing commands (and full colour) like lines, circles, shapes at arbitrary coordinates, but also high-level macros for framing text, drawing trees and matrices, 3D effects, and more.
2. MetaPost; you liked METAFONT, but never got to grips with font files? Try MetaPost (see question 4) — all the power of METAFONT, but it generates PostScript figures; MetaPost is nowadays part of most serious (L^A)T_EX distributions. Knuth uses it for all his work...
3. *Mfpic*; you liked METAFONT, but can't understand the language? The package makes up METAFONT or MetaPost code for you within using familiar-looking T_EX macros. Not *quite* the full power of METAFONT, but a friendlier interface.
4. You liked P_lCT_EX but don't have enough memory or time? Look at Eitan Gurari's *dratex*, which is as powerful as most other T_EX drawing packages, but is an entirely new implementation, which is not as hard on memory, is much more readable (and is fully documented).

dratex: graphics/dratex

mfpic: graphics/mfpic

pstricks: graphics/pstricks

158 Drawing Feynman diagrams in L^AT_EX

Michael Levine's *feynman* bundle for drawing the diagrams in L^AT_EX 2.09 is still available.

Thorsten Ohl's *feynmf* is designed to work with current L^AT_EX, and works in combination with METAFONT (or MetaPost). The *feynmf* or *feynmp* package reads a description of the diagram written in T_EX, and writes out code. METAFONT (or MetaPost) can then produce a font (or PostScript file) for use in a subsequent L^AT_EX run. For

new users, who have access to MetaPost, the PostScript version is probably the better route, for document portability and other reasons.

Jos Vermaseren's *axodraw* is mentioned as an alternative in the documentation of *feynmf*, but it is written entirely in terms of *dvips* \special commands, and is thus rather imperfectly portable.

An alternative approach is implemented by Norman Gray's *feyn* package. Rather than creating complete diagrams as postscript images, *feyn* provides a font (in a variety of sizes) containing fragments, which you can compose to produce complete diagrams. It offers fairly simple diagrams which look good in equations, rather than complicated ones more suitable for display in figures.

axodraw: graphics/axodraw/export

feyn font bundle: fonts/feyn

feynman bundle: macros/latex209/contrib/feynman

feynmf/feynmp bundle:

macros/latex/contrib/supported/feynmf

159 Floats on their own on float pages

It's sometimes necessary to force a float to live on a page by itself. (It's sometimes even necessary for *every* float to live on a page by itself.) When the float fails to 'set', and waits for the end of a chapter or of the document, the natural thing to do is to declare the float as

```
\begin{figure}[p!]
```

but the overriding ! modifier has no effect on float page floats; so you have to make the float satisfy the parameters. Question 204 offers some suggestions, but doesn't solve the one-float-per-page question.

The 'obvious' solution, using the counter `totalnumber` ("total number of floats per page") doesn't work: `totalnumber` only applies to floats on 'text' pages (pages containing text as well as one or more float). So, to allow any size float to take a whole page, set `\floatpagefraction` really small, and to ensure that no more than one float occupies a page, make the separation between floats really big:

```
\renewcommand\floatpagefraction{.001}
\makeatletter
\setlength\@fpsep{\textheight}
\makeatother
```

Q.4 Footnotes

160 Footnotes in tables

The standard L^AT_EX `\footnote` command doesn't work in tables; the table traps the footnotes and they can't escape to the bottom of the page.

If your table is floating, your best bet is (unfortunately) to put the table in a `minipage` environment and to put the notes underneath the table, or to use Donald Arseneau's package *threeparttable* (which implements "table notes" proper).

Otherwise, if your table is not floating (it's just a 'tabular' in the middle of some text), there are several things you can do to fix the problem.

1. Use `\footnotemark` to position the little marker appropriately, and then put in `\footnotetext` commands to fill in the text once you've closed the `tabular` environment. This is described in Lamport's book, but it gets messy if there's more than one footnote.
2. Stick the table in a `minipage` anyway. This provides all the ugliness of footnotes in a `minipage` with no extra effort.
3. Use *threeparttable* anyway; the package is intended for floating tables, and the result might look odd if the table is not floating, but it will be reasonable.
4. Use *tabularx* or *longtable* from the L^AT_EX tools distribution; they're noticeably less efficient than the standard `tabular` environment, but they do allow footnotes.
5. Grab hold of *footnote*, and put your `tabular` environment inside a `savenotes` environment. Alternatively, say `\makesavenoteenv{tabular}` in the preamble of your document, and tables will all handle footnotes correctly.
6. Use *mdwtab* from the same bundle; it will handle footnotes properly, and has other facilities to increase the beauty of your tables. It may also cause other table-related packages (not the standard 'tools' ones, though) to become very unhappy and stop working.

footnote.sty: Distributed as part of
macros/latex/contrib/supported/mdwtools

longtable.sty: Distributed as part of
macros/latex/required/tools

mdwtab.sty: Distributed as part of
macros/latex/contrib/supported/mdwtools

threeparttable.sty: macros/latex/contrib/other/
misc/threeparttable.sty

tabularx.sty: Distributed as part of
macros/latex/required/tools

161 Footnotes in L^AT_EX section headings

The `\footnote` command is fragile, so that simply placing the command in `\section`'s arguments isn't satisfactory. Using `\protect\footnote` isn't a good idea either: the arguments of a section command are used in the table of contents and (more dangerously) potentially also in page headings. Unfortunately, there's no mechanism to suppress the footnote in the heading while allowing it in the table of contents, though having footnotes in the table of contents is probably unsatisfactory anyway.

To suppress the footnote in headings and table of contents:

- Take advantage of the fact that the mandatory argument doesn't 'move' if the optional argument is present: `\section[title]{title\footnote{title} ftn`
- Use the *footmisc* package, with package option `stable` — this modifies footnotes so that they softly and silently vanish away if used in a moving argument.

footmisc.sty: macros/latex/contrib/supported/
footmisc

}

(And similarly for `\include`.) The code assumes you always use L^AT_EX syntax for `\input`, i.e., always use braces around the argument.

The *FiNK* (“File Name Keeper”) package provides a regular means of keeping track of the current file name (with its extension), in a macro `\finkfile`. The bundle includes a `fink.el` that provides support under *emacs* with AUC-*T_EX*.

fink.sty: macros/latex/contrib/supported/fink

165 All the files used by this document

When you’re sharing a document with someone else (perhaps as part of a co-development cycle) it’s as well to arrange that both correspondents have the same set of auxiliary files, as well as the document in question. Your correspondent obviously needs the same set of files (if you use the *url* package, she has to have *url* too, for example). But suppose you have a bug-free version of the *shinynew* package but her copy is still the unstable original; until you both realise what is happening, such a situation can be very confusing.

The simplest solution is the L^AT_EX `\listfiles` command. This places a list of the files used and their version numbers in the log file. If you extract that list and transmit it with your file, it can be used as a check-list in case that problems arise.

Note that `\listfiles` only registers things that are input by the “standard” L^AT_EX mechanisms (`\documentclass`, `\usepackage`, `\input`, `\include`, `\includegraphics` and so on). But if you use T_EX primitive syntax, as in

```
\input mymacros
```

`mymacros.tex` won’t be listed by `\listfiles`, since you’ve bypassed the mechanism that records its use.

The *snapshot* package helps the owner of a L^AT_EX document obtain a list of the external dependencies of the document, in a form that can be embedded at the top of the document. The intended use of the package is the creation of archival copies of documents, but it has application in document exchange situations too.

The *bundledoc* system uses `\listfiles` to produce an archive (e.g., `.tar.gz` or `.zip`) of the files needed by your document; it comes with configuration files for use with *teTeX* and *mikTeX*. It’s plainly useful when you’re sending the first copy of a document.

bundledoc: support/bundledoc

snapshot.sty: macros/latex/contrib/supported/snapshot

166 Marking changed parts of your document

One often needs clear indications of how a document has changed, but the commonest technique, “change bars”, requires surprisingly much trickery of the programmer (the problem being that T_EX ‘proper’ doesn’t provide the programmer with any information about the “current position” from which a putative start- or end-point of a bar might be calculated; PDF_{T_EX} *does* provide the information, but we’re not aware yet of any programmer taking

advantage of the fact to write a PDF_{T_EX}-based changebar package).

The simplest package that offers change bars is Peter Schmitt’s *backgrnd.tex*; this was written as a Plain T_EX application that patches the output routine, but it appears to work at least on simple L^AT_EX documents. Wise L^AT_EX users will be alerted by the information that *backgrnd* patches their output routine, and will watch its behaviour very carefully (patching the L^AT_EX output routine is not something to undertake lightly...).

The longest-established solution is the *changebar* package, which uses `\special` commands supplied by the driver you’re using. You need therefore to tell the package which driver to generate `\specials` for (in the same way that you need to tell the *graphics* package); the list of available drivers is pretty restricted, but does include *dvips*. The package comes with a shell script *chbar.sh* (for use on Unix machines) that will compare two documents and generate a third which is marked-up with *changebar* macros to highlight changes.

The *vertbars* package uses the techniques of the *lineno* package (which must be present); it’s thus the smallest of the packages for change bar marking, since it leaves all the trickery to another package.

backgrnd.tex: macros/generic/backgrnd.tex

changebar.sty: macros/latex/contrib/supported/changebar

lineno.sty: macros/latex/contrib/supported/lineno

vertbars.sty: macros/latex/contrib/supported/misc/vertbars.sty

167 Conditional compilation

While L^AT_EX (or any other T_EX-derived package) isn’t really like a compiler, people regularly want to do compiler-like things using it. A common requirement is conditional ‘compilation’, and several L^AT_EX-specific means to this end are available.

If your requirement is for a document from which whole chapters (or the like) are missing, consider the L^AT_EX `\include/\includeonly` system. If you ‘`\include`’ your files (rather than `\input` them — see question 215), L^AT_EX writes macro traces of what’s going on at the end of each chapter to the `.aux` file; by using `\includeonly`, you can give L^AT_EX an exhaustive list of the files that are needed. Files that don’t get `\included` are skipped entirely, but the document processing continues as if they *were* there, and page, footnote, and other numbers are not disturbed. Note that you can choose which sections you want included interactively, using the *askinclude* package.

If you want to select particular pages of your document, use Heiko Oberdiek’s *pagesel* or the *selectp* packages. You can do something similar with an existing PDF document (which you may have compiled using *pdflatex* in the first place), using the *pdfpages* package. The job is then done with a document looking like:

```
\documentclass{article}
\usepackage[final]{pdfpages}
\begin{document}
```

```
\includepdf [pages=30-40]{yoursource.pdf}
\end{document}
```

(To include all of the document, you write

```
\includepdf [pages=-]{yoursource.pdf}
```

omitting the start and end pages.)

If you want flexible facilities for including or excluding small portions of a file, consider the *comment*, *version* or *optional* packages.

comment allows you to declare areas of a document to be included or excluded; you make these declarations in the preamble of your file. Its exclusion method is pretty robust, and can cope with ill-formed bunches of text (e.g., with unbalanced braces or `\if` commands).

version offers similar facilities to `comment.sty`; it's far "lighter weight", but is less robust (and in particular, cannot deal with very large areas of text being included/excluded).

optional defines a command `\opt`; its first argument is an 'inclusion flag', and its second is text to be included or excluded. Text to be included or excluded must be well-formed (nothing mismatched), and should not be too big — if a large body of text is needed, `\input` should be used in the argument. The documentation (in the package file itself) tells you how to declare which sections are to be included: this can be done in the document preamble, but the documentation also suggests ways in which it can be done on the command line that invokes \LaTeX , or interactively.

Finally, *verbatim* (which should be available in any distribution) defines a `comment` environment, which enables the dedicated user of the source text editor to suppress bits of a \LaTeX source file.

```
askinclude.sty: macros/latex/contrib/other/
misc/askinclude.sty
```

```
comment.sty: macros/latex/contrib/other/comment
```

```
optional.sty: macros/latex/contrib/other/misc/
optional.sty
```

```
pagesel.sty: macros/latex/contrib/supported/
oberdiek
```

```
pdfpages.sty: macros/latex/contrib/supported/
pdfpages
```

```
selectp.sty: macros/latex/contrib/other/misc/
selectp.sty
```

```
verbatim.sty: Distributed as part of
macros/latex/required/tools
```

```
version.sty: macros/latex/contrib/other/misc/
version.sty
```

168 Bits of document from other directories

A common way of constructing a large document is to break it into a set of files (for example, one per chapter) and to keep everything related to each of these subsidiary files in a subdirectory.

Unfortunately, \TeX doesn't have a changeable "current directory", so that all files you refer to have to be specified relative to the same directory as the main file. Most people find this counter-intuitive.

It may be appropriate to use the "path extension" technique of question 104 to deal with this problem. However, if there several files with the same name in your document, such as `chapter1/fig1.eps` and `chapter2/fig1.eps`, you're not giving \TeX any hint as to which you're referring to when in the main chapter file you say `\input{sect1}`; while this is readily soluble in the case of human-prepared files (just don't name them all the same), automatically produced files have a way of having repetitious names, and changing *them* is a procedure prone to error.

The *import* package comes to your help here: it defines an `\import` command that accepts a full path name and the name of a file in that directory, and arranges things to "work properly". So, for example, if `/home/friend/results.tex` contains

```
Graph: \includegraphics{picture}
\input{explanation}
```

then `\import{/home/friend/}{results}` will include both graph and explanation as one might hope. A `\subimport` command does the same sort of thing for a subdirectory (a relative path rather than an absolute one), and there are corresponding `\includefrom` and `\subincludefrom` commands.

```
import.sty: macros/latex/contrib/supported/
misc/import.sty
```

169 Version control using RCS or CVS

If you use RCS or CVS to maintain your (\LaTeX) documents under version control, you may need some mechanism for including the RCS keywords in your document, in such a way that they can be typeset (that is, rather than just hiding them inside a comment).

The most complete solution is to use the (\LaTeX) package *rscs*, which allows you to parse and display the contents of RCS keyword fields in an extremely flexible way.

If you need a solution which works without using external packages, or which will work in plain \TeX , then you can use the following quick (but usually adequate) hack:

```
\def\RCS$#1: #2 $\{\expandafter
\def\cscname RCS#1\endcscname{#2}%
}
\RCS$Revision: 1.89 $ % or any RCS keyword
\RCS$Date: 2002/05/21 11:02:13 $
...
\date{Revision \RCSRevision, \RCSDate}
```

```
rscs.sty: macros/latex/contrib/supported/rscs
```

Q.6 Hyphenation

170 My words aren't being hyphenated

Let's assume you've selected the right \TeX 'language' — as explained in question 41, you're not likely to get the correct results typesetting one language using the hyphenation rules of another. (Select the proper language, using *babel* if you're a \LaTeX user. This may reveal that you need another set of hyphenation patterns; see question 174 for advice on how to install it.)

So what else can go wrong?

- Since T_EX version 3.0, the limits on how near to either end of a word hyphenation may take place have been programmable (see question 171), and for some reason the values in question may have been corrupted in some macros you are using. T_EX won't hyphenate less than `\lefthyphenmin` characters after the start of a word, nor less than `\righthyphenmin` before the end of a word; thus it won't hyphenate a word shorter than the sum of the two minima, at all. For example, since the minima are 2 and 3 for English, T_EX won't hyphenate a word shorter than 5 letters long, if it believes the word to be English.
- T_EX won't hyphenate a word that's already been hyphenated. For example, the (caricature) English surname Smyth-Postlethwaite wouldn't hyphenate, which could be troublesome. This is correct English typesetting style (it may not be correct for other languages), but if needs must, you can replace the hyphen in the name with a `\hyph` command, defined

```
\def\hyph{\penalty0\skip0pt\relax}
```

This is *not* the sort of thing this FAQ would ordinarily recommend... The *hyphenat* package defines a bundle of such commands (for introducing hyphenation points at various punctuation characters).
- There may be accents in the word. The causes of and remedies for this effect are discussed in question 173.
- The hyphenation may simply not have been spotted; while T_EX's algorithm is good, it's not infallible, and it does miss perfectly good hyphenations in some languages. When this happens, you need to give T_EX *explicit* instructions on how to hyphenate.

The `\hyphenation` command allows you to give explicit instructions. Provided that the word will hyphenate at all (that is, it is not prevented from hyphenating by any of the other restrictions above), the command will override anything the hyphenation patterns might dictate. The command takes one or more hyphenated words as argument — `\hyphenation{ana-lysis pot-able}`; note that (as here, for analysis) you can use the command to overrule T_EX's choice of hyphenation (ana-lysis is the British etymological hyphenation; some feel the American hyphenation feels 'unfortunate'...).

hyphenat.sty: macros/latex/contrib/supported/hyphenat

171 Weird hyphenation of words

If your words are being h-yphenated, like this, with just single letters at the beginning or the end of the word, you may have a version mismatch problem. T_EX's hyphenation system changed between version 2.9 and 3.0, and macros written for use with version 2.9 can have this effect with a version 3.0 system. If you are using Plain T_EX, make sure your `plain.tex` file has a version number which is at least 3.0, and rebuild your format. If you are using L^AT_EX 2.09 your best plan is to upgrade to L^AT_EX 2_ε. If for some reason you can't, the last version of L^AT_EX 2.09 (released on 25 March 1992) is still available (for the time being at least) and ought to solve this problem.

If you're using L^AT_EX 2_ε, the problem probably arises from your `hyphen.cfg` file, which has to be created if you're using a multi-lingual version.

A further source of oddity can derive from the 1995 release of Cork-encoded fonts (see question 42), which introduced an alternative hyphen character. The L^AT_EX 2_ε configuration files in the font release specified use of the alternative hyphen, and this could produce odd effects with words containing an explicit hyphen. The font configuration files in the December 1995 release of L^AT_EX 2_ε do *not* use the alternative hyphen character, and therefore removed this source of problems; the solution, again, is to upgrade your L^AT_EX.

L^AT_EX 2.09: obsolete/macros/latex209/distrib/latex209.tar

plain.tex: macros/plain/base

172 (Merely) peculiar hyphenation

You may have found that T_EX's famed automatic word-division does not produce the break-points recommended by your dictionary. This may be because T_EX is set up for American English, whose rules for word division (as specified, for example, in Webster's Dictionary) are completely different from the British ones (as specified, for example, in the Oxford Dictionaries). This problem is being addressed by the UK T_EX User community (see *Baskerville*, issue 4.4) but an entirely satisfactory solution will take time; the current status is to be found on CTAN (see question 174 for instructions on adding this new "language").

UK *patterns*: language/hyphenation/ukhyphen.tex

173 Accented words aren't hyphenated

T_EX's algorithm for hyphenation gives up when it encounters an `\accent` command; there are good reasons for this, but it means that quality typesetting in non-English languages can be difficult.

For T_EX macro packages, you can avoid the effect by using an appropriately encoded font (for example, a Cork-encoded font — see question 42) which contains accented letters as single glyphs. L^AT_EX users can achieve this end simply by adding the command

```
\usepackage[T1]{fontenc}
```

to the preamble of their document. Other encodings (notably LY1, promoted by Y&Y — see question 55) may be used in place of T1. Indeed, most current 8-bit T_EX font encodings will 'work' with the relevant sets of hyphenation patterns.

In the future, perhaps, Omega (see question 236) will provide a rather different solution.

174 Using a new language with Babel

Babel is capable of working with a large range of languages, and a new user often wants to use a language that her T_EX installation is not set up to employ. Simply asking Babel to use the language, with the command

```
\usepackage[catalan]{babel}
```

provokes the warning message

```
Package babel Warning: No hyphenation patterns
... were loaded for the language 'Catalan'
```

... I will use the patterns loaded for
... \language=0 instead.

(The layout of the error message isn't quite like this; the language name *is* capitalised, though.)

The problem is that your T_EX system doesn't know how to hyphenate Catalan text: you need to tell it how before Babel can do its work properly. To do this, for L^AT_EX installations, one needs to change `language.dat` (which is part of the Babel installation); it will contain a line

```
%catalan          cahyphen.tex
```

which, if you remove the comment marker, is supposed to instruct L^AT_EX to load Catalan hyphenation patterns when you tell it to build a new format.

Unfortunately, in many Babel distributions, the line just isn't right — you need to check the name of the file containing the patterns you're going to use. As you can see, in the author's system, the name is supposed to be `cahyphen.tex`; however the file actually present on the system is `cahyph.tex` — fortunately, the error should prove little more than an inconvenience (most of the files are in better distributions anyway, but an elusive one may be found on CTAN; if you have to retrieve a new file, ensure that it's correctly installed, for which see question 102).

Finally, you need to regenerate the formats used (in fact, most users of Babel are using it in their L^AT_EX documents, so regenerating the L^AT_EX-related formats will ordinarily be enough; however, the author always generates the lot, regardless).

teT_EX, fpT_EX To regenerate all formats, do:

```
fmtutil --all
```

If you're willing to think through what you're doing (this is *not* for the faint-hearted), you can select a sequence of formats and for each one, run:

```
fmtutil --byfmt <formatname>
```

where *formatname* is something like 'latex', or:

```
fmtutil --byhyphen <hyphenfile>
```

where *hyphenfile* is the file specifying hyphenation to the format — usually `language.dat`

MikT_EX On a *MikTeX* distribution earlier than v2.0, do:

```
Start→Programs→MikTeX→Maintenance→
```

```
Create all format files
```

```
or get a DOS window and run:
```

```
initexmf --dump
```

On a *MikTeX* distribution v2.0 or later, the whole procedure can be done via the GUI. To select the new language, do:

```
Start→Programs→MikTeX 2→MikTeX Options,
```

and select the **Languages** tab. Select your language from the list, press the **Apply** button, and then the **OK** button. Then select the **General** tab and press the **Update Now** button.

Otherwise, edit the `language.dat` file (as outlined above), and then run:

```
initexmf --dump
```

```
just as for a pre-v2.0 system.
```

Caveat: It is (just) possible that your T_EX system may run out of "pattern memory" while generating the new

format. Most T_EX implementations have fixed-size arrays for storing the details of hyphenation patterns, but although their size is adjustable in most modern distributions, actually changing the size is a fiddle. If you *do* find you've run out of memory, it may be worth scanning the list of languages in your `language.dat` to see whether any could reasonably be removed.

```
babel: macros/latex/required/babel
```

```
hyphenation patterns: language/hyphenation
```

175 Stopping all hyphenation

It may seem an odd thing to want to do (after all, one of T_EX's great advertised virtues is the quality of its hyphenation) but it's sometimes necessary. The real problem is, that the quality of T_EX's is by default largely dependent on the presence of hyphenation; if you want to abandon hyphenation, something has to give.

T_EX (slightly confusingly) offers four possible mechanisms for suppressing hyphenation (there were only two prior to the extensions that arrived with T_EX version 3).

First, one can set the hyphenation penalties `\hyphenpenalty` and `\exhyphenpenalty` to an 'infinite' value (that is to say, 10000). This means that all hyphenations will sufficiently penalise the line that would contain them, that the hyphenation won't happen. The disadvantage of this method is that T_EX will re-evaluate any paragraph for which hyphenations might help, which will slow T_EX down.

Second, one can select a language for which no hyphenation patterns exist. Some distributions create a language `nohyphenation`, and the *hyphenat* package uses this technique for its `\nohyphens` command which sets its argument without any hyphenation.

Third, one can set `\left-` and/or `\righthyphenmin` to a sufficiently large value that no hyphenation could possibly succeed, since the minimum is larger than the length of the longest word T_EX is willing to hyphenate (the appropriate value is 62).

Fourth, one can suppress hyphenation for all text using the current font by the command

```
\hyphenchar\font=-1
```

This isn't a particularly practical way for users to suppress hyphenation — the command has to be issued for every font the document uses — but it's how L^AT_EX itself suppresses hyphenation in `tt` and other fixed-width fonts.

Which of the techniques you should use depends on what you actually want to do. If the text whose hyphenation is to be suppressed runs for less than a paragraph, your only choice is the no-hyphens language: the language value is preserved along with the text (in the same way that the current font is); the values for penalties and hyphen minima active at the end of a paragraph are used when hyphenation is calculated.

Contrariwise, if you are writing a multilanguage document using the *babel* package, you *cannot* suppress hyphenation throughout using either the no-hyphens language or the hyphen minima: all those values get changed at a *babel* language switch: use the penalties instead.

If you simply switch off hyphenation for a good bit of text, the output will have a jagged edge (with many lines

seriously overfull), and your \LaTeX run will bombard you with warnings about overfull and underfull lines. To avoid this you have two options. You may use `\sloppy` (or its environment version `sloppypar`), and have \TeX stretch what would otherwise be underfull lines to fill the space offered, and wrap other lines, while prematurely wrapping overfull lines and stretching the remainder. Alternatively, you may set the text ragged right (see question 129), and at least get rid of the overfull lines; this technique is ‘traditional’ (in the sense that typists do it) and may be expected to appeal to the specifiers of eccentric document layouts (such as those for dissertations), but for once their sense conforms with typographic style. (Or at least, style constrained in this curious way.)

hyphenat.sty: macros/latex/contrib/supported/hyphenat

Q.7 Odds and ends

176 Typesetting all those \TeX -related logos

Knuth was making a particular point about the capabilities of \TeX when he defined the logo. Unfortunately, many believe, he thereby opened floodgates to give the world a whole range of rather silly ‘bumpy road’ logos such as $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\TeX$, $\text{Pic}\TeX$, $\text{Bib}\TeX$, and so on, produced in a flurry of different fonts, sizes, and baselines — indeed, everything one might hope to cause them to obstruct the reading process. In particular, L^A \TeX (silly enough in itself) and marketing input from Addison-Wesley led to the even stranger current logo $\LaTeX 2_{\epsilon}$.

Sensible users don’t have to follow this stuff wherever it goes, but, for those who insist, a large collection of logos is defined in the *texnames* package (but note that this set of macros isn’t entirely reliable in $\LaTeX 2_{\epsilon}$). The METAFONT and MetaPost logos can be set in fonts that $\LaTeX 2_{\epsilon}$ knows about (so that they scale with the surrounding text) using the *mflogo* package; but be aware that booby-traps surround the use of the Knuthian font for MetaPost (you might get `META O T`). You needn’t despair, however — the author himself uses just ‘MetaPost’.

For those who don’t wish to acquire the ‘proper’ logos, the canonical thing to do is to say `AMS-\TeX{}` ($\text{AMS}\text{-}\TeX$) for $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\TeX$, `Pic\TeX{}` ($\text{Pic}\TeX$) for $\text{Pic}\TeX$, `Bib\TeX{}` ($\text{Bib}\TeX$) for $\text{Bib}\TeX$, and so on.

While the author of this FAQ list can’t quite bring himself to do away with the bumpy-road logos herein, he regularly advises everyone else to...

mflogo.sty: macros/latex/contrib/supported/mflogo

texnames.sty: macros/eplain/texnames.sty

177 Referring to things by their name

\LaTeX ’s labelling mechanism is designed for the impersonal world of the academic publication, in which everything has a number: an extension is necessary if we are to record the *name* of things we’ve labelled. The two packages available extend the \LaTeX sectioning commands to provide reference by the name of the section.

The *titleref* package is a simple extension which provides the command `\titleref`; it is a stand-alone package.

The *nameref* package employs the techniques of the *hyperref* package to define a `\nameref` command; it will work in documents that have *hyperref* loaded.

nameref.sty: Distributed with
macros/latex/contrib/supported/hyperref

titleref.sty: macros/latex/contrib/other/misc/titleref.sty

178 How to do bold-tt or bold-sc

\LaTeX , as delivered, offers no means of handling bold “teletype” or small-caps fonts. There’s a practical reason for this (Knuth never designed such fonts), but there are typographical considerations too (the “medium weight” `cmtt` font is already pretty bold (by comparison with other fixed-width fonts), and bold small-caps is not popular with many professional typographers).

There’s a set of “extra” METAFONT files on that provide bold versions of both `cmtt` and `cmcsc` (the small caps font). With modern \TeX distributions, one may bring these fonts into use simply by placing them in an appropriate place in the *texmf* tree (see question 103); \TeX (and friends) will automatically build whatever font files they need when you first make reference to them. There’s a jiffy package *bold-extra* that builds the necessary font data structures so that you can use the fonts within \LaTeX .

If you need to use Type 1 fonts, you can’t proceed with Knuth-style fonts, since there are no Type 1 versions of the *mf-extra* set. However, commercial fixed-width fonts (including the default *Courier*) almost always come with a bold variant, so that’s not a problem. Furthermore PSNFSS (see question 82) typically provides “faked” small caps fonts, and has no compunctions about providing them in a bold form.

bold-extra.sty: macros/latex/contrib/other/misc/bold-extra.sty

bold tt and small caps fonts:
fonts/cm/mf-extra/bold

R Symbols, etc.

179 Symbols for the number sets

It is a good idea to have commands such as `\R` for the real numbers and other standard number sets. Traditionally these were typeset in bold. Because mathematicians usually do not have access to bold chalk, they invented the special symbols that are now often used for `\R`, `\C`, etc. These symbols are known as “blackboard bold”. Before insisting on using them, consider whether going back to the old system of ordinary bold might not be acceptable (it is certainly simpler).

A set of blackboard bold capitals is available in the AMS “msbm” fonts (“msbm” is available at a range of design sizes, with names such as “msbm10”). The pair of font families (the other is called “msam”) have a large number of mathematical symbols to supplement the ones in the standard \TeX distribution, and are available in

Type 1 format with most modern distributions. Support files for using the fonts, both under Plain \TeX and \LaTeX (packages *amssymb* and *amsfonts*), are available.

Another complete set of blackboard bold fonts written in METAFONT is the *bbold* family. This set has the interesting property of offering blackboard bold forms of lower-case letters, something rather rarely seen on actual blackboards; the font source directory also contains sources for a \LaTeX package that enables use of the fonts. The fonts are not available in Type 1 format.

An alternative source of Type 1 fonts with blackboard bold characters may be found in the steadily increasing set of complete families, both commercial and free, that have been prepared for use with (\LaTeX) \TeX (see question 86). Of the free sets, the *txfonts* and *pxfonts* families both come with replicas of *msam* and *msbm*, and the *mathpazo* family includes a “mathematically significant” choice of blackboard bold characters.

The “lazy person’s” blackboard bold macros:

```
\newcommand{\R}{\sf R\hspace*{-0.9ex}%
\rule{0.15ex}{1.5ex}\hspace*{0.9ex}}
\newcommand{\N}{\sf N\hspace*{-1.0ex}%
\rule{0.15ex}{1.3ex}\hspace*{1.0ex}}
\newcommand{\Q}{\sf Q\hspace*{-1.1ex}%
\rule{0.15ex}{1.5ex}\hspace*{1.1ex}}
\newcommand{\C}{\sf C\hspace*{-0.9ex}%
\rule{0.15ex}{1.3ex}\hspace*{0.9ex}}
```

work well at normal size if the surrounding text is *cmr10*. However, they are not part of a proper maths font, and so do not work in sub- and superscripts. Moreover, the size and position of the vertical bar can be affected by the font of the surrounding text.

AMS support files (Plain):

fonts/amsfonts/plaintex

AMS support files (LaTeX): fonts/amsfonts/latex

AMS symbol fonts: fonts/amsfonts/sources/symbols

AMS symbol fonts in Type 1 format: Browse
fonts/amsfonts/ps-type1

bbold fonts: fonts/bbold

mathpazo fonts: fonts/mathpazo

pxfonts: fonts/pxfonts

txfonts: fonts/txfonts

180 Better script fonts for maths

The font selected by $\backslash\mathcal$ is the only script font ‘built in’. However, there are other useful calligraphic fonts included with modern \TeX distributions.

Euler The *eucal* package (part of most sensible \TeX distributions; the fonts are part of the AMS font set) gives a slightly curlier font than the default. The package changes the font that is selected by $\backslash\mathcal$.

Type 1 versions of the fonts are available in the AMS fonts distribution.

RSFS The *mathrsfs* package uses a really fancy script font (the name stands for “Ralph Smith’s Formal Script”) which is already part of most modern \TeX

distributions. The package creates a new command $\backslash\mathscr$.

Type 1 versions of the font have been made available by Taco Hoekwater.

Zapf Chancery is the standard PostScript calligraphic font. There is no package but you can easily make it available by means of the command

```
\DeclareMathAlphabet{\mathscr}{OT1}{pzc}{m}{it}
```

in your preamble. You may find the font rather too big; if so, you can use a scaled version of it like this:

```
\DeclareFontFamily{OT1}{pzc}{}
\DeclareFontShape{OT1}{pzc}{m}{it}{
<-> s * [0.900] pzcmi7t}{}
\DeclareMathAlphabet{\mathscr}{OT1}{pzc}{m}{it}
```

Adobe Zapf Chancery (which the above examples use) is distributed in any but the most basic PostScript printers. A substantially identical font (to the extent that the same metrics may be used) is available from URW and is distributed with *ghostscript*.

Examples of the available styles are available on CTAN.

eucal.sty: fonts/amsfonts/latex/eucal.sty

euler fonts: fonts/amsfonts/sources/euler

euler fonts, in Type 1 format:

fonts/amsfonts/ps-type1

ghostscript: Browse nonfree/support/ghostscript

mathrsfs.sty: Distributed as part of
macros/latex/contrib/supported/jknappen

rsfs fonts: fonts/rsfs

rsfs fonts, in Type 1 format:

fonts/rsfs/ps-type1/hoekwater

Script font examples: info/symbols/math/
scriptfonts.pdf

181 Setting bold Greek letters in \LaTeX

The issue here is complicated by the fact that $\backslash\mathbf$ (the command for setting bold *text* in \TeX maths) affects a select few mathematical symbols (the uppercase Greek letters). However lower-case Greek letters behave differently from upper-case Greek letters (due to Knuth’s esoteric font encoding decisions). However, $\backslash\mathbf$ can’t be used even for upper-case Greek letters in the \mathcal{AMS} - \LaTeX *amsmath* package, which disables this font-switching and you must use one of the techniques outlined below.

The Plain \TeX solution *does* work, in a limited way:

```
{\boldmath$\theta$}
```

but $\backslash\boldmath$ may not be used in maths mode, so this ‘solution’ requires arcana such as:

```
$. . . \mbox{\boldmath$\theta$} . . . $
```

which then causes problems in superscripts, etc.

These problems may be addressed by using a bold mathematics package.

- The *bm* package, which is part of the \LaTeX tools distribution, defines a command $\backslash\mathbf$ which may be used anywhere in maths mode.

- The *amsbsy* package (which is part of $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$) defines a command `\boldsymbol`, which (though slightly less comprehensive than `\bm`) covers almost all common cases.

All these solutions cover all mathematical symbols, not merely Greek letters.

bm.sty: Distributed as part of
 macros/latex/required/tools

amsbsy.sty: Distributed as part of the $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$
 distribution macros/latex/required/amslatex

amsmath.sty: Distributed as part of the $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$
 distribution macros/latex/required/amslatex

182 The Principal Value Integral symbol

This symbol (an integral sign, ‘crossed’) does not appear in any of the fonts ordinarily available to $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ users, but it can be created by use of the following macros:

```
\def\Xint#1{\mathchoice
  {\XXint\displaystyle\textstyle{#1}}%
  {\XXint\textstyle\scriptstyle{#1}}%
  {\XXint\scriptstyle\scriptscriptstyle{#1}}%
  {\XXint\scriptscriptstyle
    \scriptscriptstyle{#1}}%
  \!\int}
\def\XXint#1#2#3{%
  \setbox0=\hbox{#1{#2#3}{\int}$}
  \vcenter{\hbox{#2#3}}\kern-.5\wd0}}
\def\ddashint{\Xint=}
\def\dashint{\Xint-}
```

`\dashint` gives a single-dashed integral sign, `\ddashint` a double-dashed one.

183 How to use the underscore character

The underscore character `_` is ordinarily used in $\mathcal{T}\mathcal{E}\mathcal{X}$ to indicate a subscript in maths mode; if you type `_` in the course of ordinary text, $\mathcal{T}\mathcal{E}\mathcal{X}$ will complain. If you’re writing a document which will contain a large number of underscore characters, the prospect of typing `_` (or, worse, `\textunderscore`) for every one of them will daunt most ordinary people.

Moderately skilled macro programmers can readily generate a quick hack to permit typing `_` to mean ‘text underscore’. However, the code *is* somewhat tricky, and more importantly there are significant points where it’s easy to get it wrong. There is therefore a package *underscore* which provides a general solution to this requirement.

underscore.sty: macros/latex/contrib/other/
 misc/underscore.sty

184 How to type an ‘@’ sign?

Long ago, some packages used to make the ‘@’ sign active, so that special measures were needed to type it. While those packages are still in principle available, few people use them, and those that do use them have ready access to rather good documentation.

Ordinary people (such as the author of this FAQ) need only type ‘@’.

185 Typesetting the Euro sign

The European currency “Euro” is represented by a symbol of somewhat dubious design, but it’s an important currency and $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ users need to typeset it.

Note that the Commission of the European Community at first deemed that the Euro symbol should always be set in a sans-serif font; fortunately, this eccentric ruling has now been rescinded, and one may apply best typesetting efforts to making it appear at least slightly “respectable” (typographically).

The TS1-encoded fonts provided as part of the EC font distribution provide Euro glyphs. The fonts are called Text Companion (TC) fonts, and offer the same range of faces as do the EC fonts themselves. The *textcomp* package provides a `\texteuro` command for accessing the symbol, which selects a symbol to match the surrounding text. The design of the symbol in the TC fonts is not universally loved. . . Nevertheless, use the TC font version of the symbol if you are producing documents using Knuth’s Computer Modern Fonts.

The *latin9* input encoding defined by the *inputenc* package has a euro character defined (character position 164, occupied in other ISO Latin character sets by the “currency symbol”). The encoding uses the command `\texteuro` for the character; at present that command is *only* available from the *textcomp* package. There is a Microsoft code page position, too, but standardisation of such things proceeds via rather different routes and the $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ project hasn’t yet been given details of the change.

Outline fonts which contain nothing but Euro symbols are available (free) from Adobe (see <ftp://ftp.adobe.com/pub/adobe/type/win/all/eurofont.exe>) — the file is packaged as a *Windows* self-extracting executable, but it may be decoded as a .zip format archive on other operating systems. The *euro* bundle contains metrics, *dvips* map files, and macros (for Plain $\mathcal{T}\mathcal{E}\mathcal{X}$ and $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$), for using these fonts in documents. $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ users will find two packages in the bundle: *eurosans* only offers the sans-serif version (to conform with the obsolete ruling about sans-serif-only symbols; the package provides the command `\euro`), whereas *europ*s matches the Euro symbol with the surrounding text (providing the command `\EUR`). To use either package with the *latin9* encoding, you need to define `\texteuro` as an alias for the euro command the package defines.

The Adobe fonts are probably the best bet for use in non-Computer Modern environments. They are apparently designed to fit with Adobe Times, Helvetica and Courier, but can probably fit with a wider range of modern fonts.

The *eurofont* package provides a compendious analysis of the “problem of the euro symbol” in its documentation, and offers macros for configuring the source of the glyphs to be used; however, it seems rather large for everyday use.

Euro symbols are found in several other places, which we list here for completeness.

The *marvosym* fonts contain a Euro symbol among many other good things; the font on CTAN is not Adobe *ATM* compatible, but a compatible version is available free from Y&Y (see <http://www.YandY.com/download/>)

marvosym.zip). The font on CTAN comes with a set of macros to typeset all the symbols it contains.

Other METAFONT-based bundles containing Euro symbols are to be found in *china2e* (whose primary aim is Chinese dates and suchlike matters) and the *eurosym* fonts.

china2e bundle: macros/latex/contrib/supported/china2e

EC fonts: fonts/ec

euro fonts: fonts/euro

eurofont.sty: macros/latex/contrib/supported/eurofont

eurosym fonts: fonts/eurosym

marvosym fonts: fonts/psfonts/marvosym

textcomp.sty: Part of the L^AT_EX distribution.

S Macro programming

186 Finding the width of a letter, word, or phrase

Put the word in a box, and measure the width of the box. For example,

```
\newdimen\stringwidth
\setbox0=\hbox{hi}
\stringwidth=\wd0
```

Note that if the quantity in the `\hbox` is a phrase, the actual measurement only approximates the width that the phrase will occupy in running text, since the inter-word glue can be adjusted in paragraph mode.

The same sort of thing is expressed in L^AT_EX by:

```
\newlength{\gnat}
\settowidth{\gnat}{\textbf{small}}
```

This sets the value of the length command `\gnat` to the width of “small” in bold-face text.

187 How to change L^AT_EX’s “fixed names”

L^AT_EX document classes define several typographic operations that need ‘canned text’ (text not supplied by the user). In the earliest days of L^AT_EX 2.09 these bits of text were built in to the body of L^AT_EX’s macros and were rather difficult to change, but “fixed name” macros were introduced for the benefit of those wishing to use L^AT_EX in languages other than English. For example, the special section produced by the `\tableofcontents` command is always called `\contentsname` (or rather, what `\contentsname` is defined to mean). Changing the canned text is now one of the easiest customisations a user can do to L^AT_EX.

The canned text macros are all of the form `\langle thing \rangle name`, and changing them is simplicity itself. Put:

```
\renewcommand{\langle thing \rangle name}{Res minor}
```

in the preamble of your document, and the job is done. (However, beware of the *babel* package, which requires you to use a different mechanism: be sure to check question 188 if you’re using it.)

The names that are defined in the standard L^AT_EX classes (and the *makeidx* package) are listed below. Some of the names are only defined in a subset of the classes (and the *letter* class has a set of names all of its own); the list shows the specialisation of each name, where appropriate.

<code>\abstractname</code>	Abstract
<code>\alsoname</code>	see also (<i>makeidx</i> package)
<code>\appendixname</code>	Appendix
<code>\bibname</code>	Bibliography (<i>report,book</i>)
<code>\ccname</code>	cc (<i>letter</i>)
<code>\chaptername</code>	Chapter (<i>report,book</i>)
<code>\contentsname</code>	Contents
<code>\enclname</code>	encl (<i>letter</i>)
<code>\figurename</code>	Figure (for captions)
<code>\headtoname</code>	To (<i>letter</i>)
<code>\indexname</code>	Index
<code>\listfigurename</code>	List of Figures
<code>\listtablename</code>	List of Tables
<code>\pagename</code>	Page (<i>letter</i>)
<code>\partname</code>	Part
<code>\refname</code>	References (<i>article</i>)
<code>\seename</code>	see (<i>makeidx</i> package)
<code>\tablename</code>	Table (for captions)

188 Changing the words *babel* uses

L^AT_EX uses symbolic names for many of the automatically-generated text it produces (special-purpose section headers, captions, etc.). As noted in question 187 (which includes a list of the names themselves), this enables the user to change the names used by the standard classes, which is particularly useful if the document is being prepared in some language other than L^AT_EX’s default English. So, for example, a Danish author may wish that her table of contents was called “Indholdsfortegnelse”, and so would expect to place a command

```
\renewcommand{\contentsname}{%
  {Indholdsfortegnelse}}
```

in the preamble of her document.

However, it’s natural for a user of a non-English language to use *babel*, because it offers many conveniences and typesetting niceties for those preparing documents in those languages. In particular, when *babel* is selecting a new language, it ensures that L^AT_EX’s symbolic names are translated appropriately for the language in question. Unfortunately, *babel*’s choice of names isn’t always to everyone’s choice, and there is still a need for a mechanism to replace the ‘standard’ names.

Whenever a new language is selected, *babel* resets all the names to the settings for that language. In particular, *babel* selects the document’s main language when `\begin{document}` is executed, which immediately destroys any changes to these symbolic names made in the prologue of a document that uses *babel*.

Therefore, *babel* defines a command to enable users to change the definitions of the symbolic names, on a per-language basis: `\addto\captions(language)` is the thing (`\langle language \rangle` being the language option you gave to *babel* in the first place). For example:

```
\addto\captionsdanish{%
  \renewcommand{\contentsname}{%
    {Indholdsfortegnelse}}}
```

```
{Indholdsfortegnelse}%
}
```

189 Running equation, figure and table numbering

Many L^AT_EX classes (including the standard *book* class) number things per chapter; so figures in chapter 1 are numbered 1.1, 1.2, and so on. Sometimes this is not appropriate for the user's needs.

Short of rewriting the whole class, one may use one of the *removefr* and *remreset* packages; both define a `\@removefromreset` command, and having included the package one writes something like:

```
\makeatletter
\@removefromreset{figure}{chapter}
```

and the automatic renumbering stops. You then need to redefine the way in which the figure number (in this case) is printed:

```
\renewcommand{\thefigure}{\@arabic\c@figure}
\makeatother
```

(remember to do the whole job, for every counter you want to manipulate, within `\makeatletter ... \makeatother`).

The technique may also be used to change where in a multilevel structure a counter is reset. Suppose your class numbers figures as `<chapter>.<section>.<figure>`, and you want figures numbered per chapter, try:

```
\@removefromreset{figure}{section}
\@addtoreset{figure}{chapter}
\renewcommand{\thefigure}%
    {\thechapter.\@arabic\c@figure}
```

(the command `\@addtoreset` is a part of L^AT_EX itself).

The *chngcntr* package provides a simple means to access the two sorts of changes discussed, defining `\counterwithin` and `\counterwithout` commands.

chngcntr.sty: macros/latex/contrib/supported/misc/chngcntr.sty

removefr.tex: macros/latex/contrib/other/fragments/removefr.tex (note, this is constructed as a “fragment” for use within other packages: load by `\input {removefr}`)

remreset.sty: Distributed as part of macros/latex/contrib/supported/carlsisle

190 Patching existing commands

In the general case (possibly sticking something in the middle of an existing command) this is difficult. However, the common requirement, to add some code at the beginning or the end of an existing command, is conceptually quite easy. Suppose we want to define a version of a command that does some small extension of its original definition: we would naturally write:

```
\renewcommand{\splat}{\mumble\splat}
```

However, this would not work: a call to `\splat` would execute `\mumble`, and the call the redefined `\splat` again; this is an infinite recursive loop, that will quickly exhaust T_EX's memory.

Fortunately, the T_EX primitive `\let` command comes to our rescue; it allows us to take a “snapshot” of the current state of a command, which we can then use in the redefinition of the command. So:

```
\let\OldSmooth\smooth
\renewcommand{\smooth}{\mumble\OldSmooth}
```

effects the required patch, safely. Adding things at the end of a command works similarly. If `\smooth` takes arguments, one must pass them on:

```
\renewcommand{\smooth}[2]%
    {\mumble\OldSmooth{#1}{#2}}
```

The general case may be achieved in two ways. First, one can use the L^AT_EX command `\CheckCommand`; this compares an existing command with the definition you give it, and issues a warning if two don't match. Use is therefore:

```
\CheckCommand{\complex}{<original definition>}
\renewcommand{\complex}{<new definition>}
```

This technique is obviously somewhat laborious, but if the original command comes from a source that's liable to change under the control of someone else, it does at least warn you that your patch is in danger of going wrong.

Otherwise, you may use one of the *patch* or *patchcmd* systems.

Patch gives you an ingenious (and difficult to understand) mechanism, and comes as an old-style L^AT_EX documented macro file. Sadly the old-style *doc* macros are no longer available, but the file (`patch.doc`) may be input directly, and the documentation may be read (un_typeset). Roughly speaking, one gives the command a set of instructions analogous to *sed* substitutions, and it regenerates the command thus amended. The author of this FAQ has (slightly reluctantly) given up using *patch*...

The *patchcmd* package addresses a slightly simpler task, by restricting the set of commands that you may patch; you may not patch any command that has an optional argument, though it does deal with the case of commands defined with `\DeclareRobustCommand`. The package defines a `\patchcommand` command, that takes three arguments: the command to patch, stuff to stick at the front of its definition, and stuff to stick on the end of its definition. So, if `\b` contains “b”, then `\patchcommand \b{a}{c}` will produce a new version of `\b` that contains “abc”.

patch.doc: macros/generic/patch.doc

patchcommand.sty: macros/latex/contrib/supported/patchcmd

191 \@ and @ in macro names

Macro names containing `@` are *internal* to L^AT_EX, and without special treatment just don't work in ordinary use. An exemplar of the problems caused is discussed in question 232.

The problems users see are caused by copying bits of a class (`.cls` file) or package (`.sty` file) into a document, or by including a class or package file into a L^AT_EX document by some means other than `\documentclass` or `\usepackage`. L^AT_EX defines internal commands whose names contain the character `@` to avoid clashes between its internal names and names that we would normally

use in our documents. In order that these commands may work at all, `\documentclass` and `\usepackage` play around with the meaning of `@`.

If you've included a file wrongly, you solve the problem by using the correct command.

If you're using a fragment of a package or class, you may well feel confused: books such as *The L^AT_EX Companion* (see question 22) are full of fragments of packages as examples for you to employ.

For example, there's a lengthy section in *The Companion* about `\@startsection` and how to use it to control the appearance of section titles. Page 15 discusses the problem; and suggests that you make such changes in the document preamble, between `\makeatletter` and `\makeatother`. So the redefinition of `\subsection` on page 26 could be:

```
\makeatletter
\renewcommand{\subsection}{\@startsection
  {subsection}%                % name
  ...
  {\normalfont\normalsize\itshape}}% style
\makeatother
```

The alternative is to treat all these fragments as a package proper, bundling them up into a `.sty` file and including them with `\usepackage`. (This approach is marginally preferable, from the L^AT_EX purist's point of view.)

192 What's the reason for 'protection'?

Sometimes L^AT_EX saves data it will reread later. These data are often the argument of some command; they are the so-called moving arguments. ('Moving' because data are moved around.) Places to look for are all arguments that may go into table of contents, list of figures, *etc.*; namely, data that are written to an auxiliary file and read in later. Other places are those data that might appear in head- or footlines. Section headers and figure captions are the most prominent examples; there's a complete list in Lamport's book (see question 22).

What's going on really, behind the scenes? The commands in the moving arguments are already expanded to their internal structure during the process of saving. Sometimes this expansion results in invalid T_EX code when processed again. "`\protect\cmd`" tells L^AT_EX to save `\cmd` as `\cmd`, without expansion.

What is a 'fragile command'? It's a command that expands into illegal T_EX code during the save process.

What is a 'robust command'? It's a command that expands into legal T_EX code during the save process.

No-one (of course) likes this situation; the L^AT_EX3 team have removed the need for protection of some things in the production of L^AT_EX 2_ε, but the techniques available to them within current L^AT_EX mean that this is an expensive exercise. It remains a long-term aim of the team to remove all need for these things.

193 \edef does not work with \protect

Robust L^AT_EX commands are either "naturally robust" — meaning that they never need `\protect`, or "self-protected" — meaning that they have `\protect` built

in to their definition in some way. Self-protected commands are robust only in a context where the `\protect` mechanism is properly handled. The body of an `\edef` definition doesn't handle `\protect` properly, since `\edef` is a T_EX primitive rather than a L^AT_EX command.

This problem is resolved by a L^AT_EX internal command `\protected@edef`, which does the job of `\edef` while keeping the `\protect` mechanism working. There's a corresponding `\protected@xdef` which does the job of `\xdef`.

Of course, these commands need to be tended carefully, since they're internal: see question 191.

194 Optional arguments like \section

Optional arguments, in macros defined using `\newcommand`, don't quite work like the optional argument to `\section`. The default value of `\section`'s optional argument is the value of the mandatory argument, but `\newcommand` requires that you 'know' the value of the default beforehand.

The requisite trick is to use a macro in the optional argument:

```
\newcommand\thing[2][\DefaultOpt]{%
  \def\DefaultOpt{#2}%
  ...%
}
```

195 Making labels from a counter

Suppose we have a L^AT_EX counter, which we've defined with `\newcounter{foo}`. We can increment the value of the counter by `\addtocounter{foo}{1}`, but that's pretty clunky for an operation that happens so often ... so there's a command `\stepcounter{foo}` that does this special case of increasing-by-one.

There's an internal L^AT_EX variable, the "current label", that remembers the last 'labellable' thing that L^AT_EX has processed. You could (if you were to insist) set that value by the relevant T_EX command (having taken the necessary precautions to ensure that the internal command worked) — but it's not necessary. If, instead of either of the stepping methods above, you say `\refstepcounter{foo}`, the internal variable is set to the new value, and (until something else comes along), `\label` will refer to the counter.

196 Finding if you're on an odd or an even page

Question 219 discusses the issue of getting `\marginpar` commands to put their output in the correct margin of two-sided documents. This is an example of the general problem of knowing where a particular bit of text lies: the output routine is asynchronous, and (L^A)T_EX will usually process quite a bit of the "next" page before deciding to output any page. As a result, the page counter (known internally in L^AT_EX as `\c@page`) is normally only reliable when you're actually *in* the output routine.

The solution is to use some version of the `\label` mechanism to determine which side of the page you're on; the value of the page counter that appears in a `\pageref` command has been inserted in the course of the output routine, and is therefore safe.

However, `\pageref` itself isn't reliable: one might hope that

`\ifthenelse{\isodd{\pageref{foo}}}{odd}{even}` would do the necessary, but both the *babel* and *hyperref* packages have been known to interfere with the output of `\pageref`; be careful!

The *chnpage* package needs to provide this functionality for its own use, and therefore provides a command `\checkoddpage`; this sets a private-use label, and the page reference part of that label is then examined (in a *hyperref*-safe way) to set a conditional `\ifcpoddpage` true if the command was issued on an odd page. Of course, the `\label` contributes to L^AT_EX's "Rerun to get cross-references right" error messages...

chnpage.sty: macros/latex/contrib/supported/misc/chnpage.sty

197 How to change the format of labels

By default, when a label is created, it takes on the appearance of the counter labelled: specifically, it is set to `\the<counter>` — what would be used if you asked to typeset the counter in your text. This isn't always what you need: for example, if you have nested enumerated lists with the outer numbered and the inner labelled with letters, one might expect to want to refer to items in the inner list as "2(c)". (Remember, you can change the structure of list items — see question 150.) The change is of course possible by explicit labelling of the parent and using that label to construct the typeset result — something like

```
\ref{parent-item}(\ref{child-item})
```

which would be both tedious and error-prone. What's more, it would be undesirable, since you would be constructing a visual representation which is inflexible (you couldn't change all the references to elements of a list at one fell swoop).

L^AT_EX in fact has a label-formatting command built into every label definition; by default it's null, but it's available for the user to program. For any label *counter* there's a L^AT_EX internal command `\p@<counter>`; for example, a label definition on an inner list item is done (in effect) using the command `\p@enumii{\theenumii}`. So to change the labels on all inner lists, put the following patch in your preamble:

```
\makeatletter
\renewcommand{\p@enumii}[1]{\theenumi(#1)}
\makeatother
```

The analogous change works for any counter that gets used in a `\label` command.

198 Comparing the "job name"

The token `\jobname` amusingly produces a sequence of characters whose category code is 12 ('other'), regardless of what the characters actually are. Since one inevitably has to compare a macro with the contents of another macro (using `\ifx`, somewhere) one needs to create a macro whose expansion looks the same as the expansion of `\jobname`. We find we can do this with `\meaning`, if we strip the "`\show` command" prefix.

The full command looks like:

```
\def\StripPrefix#1>{}
\def\jobis#1{FF\fi
```

```
\def\predicate{#1}%
\edef\predicate{\expandafter\StripPrefix
\meaning\predicate}%
\edef\job{\jobname}%
\ifx\job\predicate
}
```

And it's used as:

```
\if\jobis{mainfile}%
\message{YES}%
\else
\message{NO}%
\fi
```

Note that the command `\StripPrefix` need not be defined if you're using L^AT_EX — there's already an internal command (see question 191) `\strip@prefix` that you can use.

199 Is the argument a number?

T_EX's own lexical analysis doesn't offer the macro programmer terribly much support: while category codes will distinguish letters (or what T_EX currently thinks of as letters) from everything else, there's no support for analysing numbers.

The simple-minded solution is to compare numeric characters with the characters of the argument, one by one, by a sequence of direct tests, and to declare the argument "not a number" if any character fails all comparisons:

```
\ifx1#1
\else\ifx2#1
...
\else\ifx9#1
\else\isanumfalse
\fi\fi...\fi
```

which one would then use in a tail-recursing macro to gobble an argument. One could do slightly better by assuming (pretty safely) that the digits' character codes are consecutive:

```
\ifnum'#1<'0 \isanumfalse
\else\ifnum'#1>'9 \isanumfalse
\fi
```

```
\fi
```

again used in tail-recursion. However, these forms aren't very satisfactory: getting the recursion "right" is troublesome (it has a tendency to gobble spaces in the argument), and in any case T_EX itself has mechanisms for reading numbers, and it would be nice to use them.

Donald Arseneau's *cite* package offers the following test for an argument being a strictly positive integer:

```
\def\IsPositive#1{%
TT\fi
\ifcat_\ifnum0<0#1 _\else A\fi
}
```

which can be adapted to a test for a non-negative integer thus:

```
\def\IsNonNegative{%
\ifcat_\ifnum9<1#1 _\else A\fi
}
```

or a test for any integer:

```

\def\gobble#1{}
\def\gobbleminus{\futurelet\temp\gobm}
\def\gobm{\ifx-\temp\expandafter\gobble\fi}
\def\IsInteger#1{%
  TT\fi
  \ifcat_\ifnum9<1\gobbleminus#1 _\else A\fi
}

```

but this surely stretches the technique further than is reasonable.

If we don't care about the sign, we can use \TeX to remove the entire number (sign and all) from the input stream, and then look at what's left:

```

\def\testnum#1{\afterassignment\testresult
  \count255=#1 \end}
\def\testresult#1\end{\ifx\end#1\end}
\def\IsInteger#1{TT\fi \testnum{#1}}

```

(which technique is due to David Kastrop). In a later thread on the same topic, Michael Downes offered:

```

\def\IsInteger#1{%
  TT\fi
  \begingroup \lccode'\-='\0 \lccode'+='\0
  \lccode'1='\0 \lccode'2='\0 \lccode'3='\0
  \lccode'4='\0 \lccode'5='\0 \lccode'6='\0
  \lccode'7='\0 \lccode'8='\0 \lccode'9='\0
  \lowercase{\endgroup
  \expandafter\ifx\expandafter\delimiter
  \romannumeral0\string#1}\delimiter
}

```

which relies on `\romannumeral` producing an empty result if its argument is zero.

All the complete functions above are designed to be used in \TeX conditionals written “naturally” — for example:

```

\if\IsInteger{<subject of test>}%
  <deal with integer>%
\else
  <deal with non-integer>%
\fi

```

200 Defining macros within macros

The way to think of this is that `##` gets replaced by `#` in just the same way that `#1` gets replaced by ‘whatever is the first argument’.

So if you define a macro and use it as:

```
\def\A#1{+++#1+++#1+++#1+++} \A{b}
```

the macro expansion produces ‘+++b+++b+++b+++’, which people find normal. However, if we now replace part of the macro:

```
\def\A#1{+++#1+++}\def\X #1{xxx#1}}
```

`\A{b}` will expand to ‘+++b+++`\def\X b{xxx#1}`’. This defines `\X` to be a macro *delimited* by `b`, and taking no arguments, which people may find strange, even though it is just a specialisation of the example above. If you want `\A` to define `\X` to be a macro with one argument, you need to write:

```
\def\A#1{+++#1+++}\def\X ##1{xxx##1}}
```

and `\A{b}` will expand to ‘+++b+++`\def\X #1{xxx#1}`’, because `#1` gets replaced by ‘b’ and `##` gets replaced by `#`.

To nest a definition inside a definition inside a definition then you need `###1`, as at each stage `##` is replaced by `#`. At the next level you need 8 `#`s each time, and so on.

201 Spaces in macros

It's very easy to write macros that produce space in the typeset output where it's neither desired nor expected. Spaces introduced by macros are particularly insidious because they don't amalgamate with spaces around the macro (in the way that consecutive spaces that you type do), so your output can have a single bloated space that proves to be made up of two or even more spaces that haven't amalgamated. And of course, your output can also have a space where none was wanted at all.

Spaces are produced, inside a macro as elsewhere, by space or tab characters, or by end-of-line characters. There are two basic rules to remember when writing a macro: first, the rules for ignoring spaces when you're typing macros are just the same as the rules that apply when you're typing ordinary text, and second, rules for ignoring spaces do *not* apply to spaces produced while a macro is being obeyed (“expanded”).

Spaces are ignored in vertical mode (between paragraphs), at the beginning of a line, and after a command name. Since sequences of spaces are collapsed into one, it ‘feels as if’ spaces are ignored if they follow another space. Space can have syntactic meaning after certain sorts of non-braced arguments (e.g., *count* and *dimen* variable assignments in Plain \TeX) and after certain control words (e.g., in `\hbox to`, so again we have instances where it ‘feels as if’ spaces are being ignored when they're merely working quietly for their living.

Consider the following macro, fairly faithfully adapted from one that appeared on `comp.text.tex`:

```

\newcommand{\stline}[1]
  { \bigskip \makebox[2cm]{ \textbf{#1} } }

```

(the original appeared on a single line: it's wrapped here to fit in the printed FAQ's narrow columns).

The macro definition contains five spaces:

- after the opening `{` of the macro body; this space will be ignored, not because “because the macro appears at the start of a line”, but rather because the macro was designed to operate between paragraphs
- after `\bigskip`; this space will be ignored (while the macro is being defined) because it follows a command name
- after the `{` of the mandatory argument of `\makebox`; even though this space will inevitably appear at the start of an output line, it will *not* be ignored
- after the `}` closing the argument of `\textbf`; this space will not be ignored, but may be overlooked if the argument is well within the 2cm allowed for it
- after the `}` closing the mandatory argument of `\makebox`; this space will not be ignored, and will appear in the argument

The original author of the macro had been concerned that the starts of his lines with this macro in them were not at the left margin, and that the text appearing after the macro wasn't always properly aligned. These problems

arose from the space at the start of the mandatory argument of `\makebox` and the space immediately after the same argument. He had written his macro in that way to emphasise the meaning of its various parts; unfortunately the meaning was rather lost in the problems the macro caused.

The principal technique for suppressing spaces is the use of `%` characters: everything after a `%` is ignored, even the end of line itself (so that not even the end of line can contribute an unwanted space). The secondary technique is to ensure that the end of line is preceded by a command name (since the end of line behaves like a space, it will be ignored following a command name). Thus the above command would be written (by an experienced programmer with a similar eye to emphasising the structure):

```
\newcommand{\stline}[1]{%
  \bigskip
  \makebox[2cm]{%
    \textbf{#1}\relax
  }%
}
```

Care has been taken to ensure that every space in the revised definition is ignored, so none appears in the output. The revised definition takes the “belt and braces” approach, explicitly dealing with every line ending (although, as noted above, a space introduced at the end of the first line of the macro would have been ignored in actual use of the macro. This is the best technique, in fact — it’s easier to blindly suppress spaces than to analyse at every point whether you actually need to. Three techniques were used to suppress spaces:

- placing a `%` character at the end of a line (as in the 1st, 3rd and 5th lines),
- ending a line ‘naturally’ with a control sequence, as in line 2, and
- ending a line with an ‘artificial’ control sequence, as in line 4; the control sequence in this case (`\relax`) is a no-op in many circumstances (as here), but this usage is deprecated — a `%` character would have been better.

Beware of the (common) temptation to place a space *before* a `%` character: if you do this you might as well omit the `%` altogether.

In “real life”, of course, the spaces that appear in macros are far more cryptic than those in the example above. The most common spaces arise from unprotected line ends, and this is an error that occasionally appears even in macros written by the most accomplished programmers.

T Things are Going Wrong...

T.1 Getting things to fit

202 Enlarging TeX

The TeX error message ‘capacity exceeded’ covers a multitude of problems. What has been exhausted is listed in brackets after the error message itself, as in:

```
! TeX capacity exceeded, sorry
```

```
.. [main memory size=263001].
```

Most of the time this error can be fixed *without* enlarging TeX. The most common causes are unmatched braces, extra-long lines, and poorly-written macros. Extra-long lines are often introduced when files are transferred incorrectly between operating systems, and line-endings are not preserved properly (the tell-tale sign of an extra-long line error is the complaint that the ‘`buf_size`’ has overflowed).

If you really need to extend your TeX’s capacity, the proper method depends on your installation. There is no need (with modern TeX implementations) to change the defaults in Knuth’s WEB source; but if you do need to do so, use a change file to modify the values set in module 11, recompile your TeX and regenerate all format files.

Modern implementations allow the sizes of the various bits of TeX’s memory to be changed semi-dynamically. Some (such as emTeX) allow the memory parameters to be changed in command-line switches when TeX is started; most frequently, a configuration file is read which specifies the size of the memory. On *web2c*-based systems, this file is called `texmf.cnf`: see the documentation that comes with the distribution for other implementations. Almost invariably, after such a change, the format files need to be regenerated after changing the memory parameters.

203 Why can’t I load Pictex?

Pictex is a resource hog; fortunately, most modern TeX implementations offer generous amounts of space, and most modern computers are pretty fast, so users aren’t too badly affected by its performance.

However, Pictex has the further unfortunate tendency to fill up TeX’s fixed-size arrays — notably the array of 256 ‘dimension’ registers. This is a particular problem when you’re using `pictex.sty` with L^ATeX and some other packages that also need dimension registers. When this happens, you will see the TeX error message:

```
! No room for a new \dimen.
```

There is nothing that can directly be done about this error: you can’t extend the number of available `\dimen` registers without extending TeX itself. (ϵ -TeX and Ω — see questions 237 and 236 respectively — both do this, as does MicroPress Inc’s VTeX — see question 55.) Since you can’t (ordinarily) extend TeX, you need to change Pictex; unfortunately Pictex’s author is no longer active in the TeX world, so one must resort to patching. There are two solutions available.

The ConTeXt module `m-pictex.tex` (for Plain TeX and variants) or the corresponding L^ATeX *m-pictex* package provide an ingenious solution to the problem based on hacking the code of `\newdimen` itself.

Alternatively, Andreas Schell’s *pictexwd* and related packages replace Pictex with a version that uses 33 fewer `\dimen` registers; so use *pictexwd* in place of *pictex* (either as a L^ATeX package, or as a file to read into Plain TeX).

And how does one use Pictex anyway, given that the manual is so hard to come by (see question 32)? Fortunately for MS-DOS and Windows users, the *MathsPic* system may be used to translate a somewhat different language into Pictex commands; and the *MathsPic* manual

is free (and part of the distribution). *MathsPic* is written in *Basic*; a version written in *Perl* is under development, and should be available soon.

m-pictex.sty: Distributed as part of
 macros/context/cont-tmf.zip

m-pictex.tex: Distributed as part of
 macros/context/cont-tmf.zip

MathsPic: graphics/pictex/mathspic

pictexwd.sty: Distributed as part of
 graphics/pictex/addon

T.2 Making things stay where you want them

204 Moving tables and figures in L^AT_EX

Tables and figures have a tendency to surprise, by *floating* away from where they were specified to appear. This is in fact perfectly ordinary document design; any professional typesetting package will float figures and tables to where they'll fit without violating the certain typographic rules. Even if you use the placement specifier `h` for 'here', the figure or table will not be printed 'here' if doing so would break the rules; the rules themselves are pretty simple, and are given on page 198, section C.9 of the L^AT_EX manual. In the worst case, L^AT_EX's rules can cause the floating items to pile up to the extent that you get an error message saying "Too many unprocessed floats" (see question 231). What follows is a simple checklist of things to do to solve these problems (the checklist talks throughout about figures, but applies equally well to tables, or to "non-standard" floats defined by the *float* or other packages).

- Do your figures need to float at all? If not, consider the `[H]` placement option offered by the *float* package: figures with this placement are made up to look as if they're floating, but they don't in fact float. Beware outstanding floats, though: the `\caption` commands are numbered in the order they appear in the document, and a `[H]` float can 'overtake' a float that hasn't yet been placed, so that figures numbers get out of order.
- Are the placement parameters on your figures right? The default (`tbp`) is reasonable, but you can reasonably change it (for example, to add an `h`). Whatever you do, *don't* omit the 'p': doing so could cause L^AT_EX to believe that if you can't have your figure *here*, you don't want it *anywhere*. (L^AT_EX does try hard to avoid being confused in this way...)
- L^AT_EX's own float placement parameters could be preventing placements that seem entirely "reasonable" to you — they're notoriously rather conservative. To encourage L^AT_EX not to move your figure, you need to loosen its demands. (The most important ones are the ratio of text to float on a given page, but it's sensible to have a fixed set that changes the whole lot, to meet every eventuality.)

```
\renewcommand{\topfraction}{.85}
\renewcommand{\bottomfraction}{.7}
\renewcommand{\textfraction}{.15}
\renewcommand{\floatpagefraction}{.66}
```

```
\renewcommand{\dbltopfraction}{.66}
\renewcommand{\dblfloatpagefraction}{.66}
\setcounter{topnumber}{9}
\setcounter{bottomnumber}{9}
\setcounter{totalnumber}{20}
\setcounter{dbltopnumber}{9}
```

The meanings of these parameters are described on pages 199–200, section C.9 of the L^AT_EX manual.

- Are there places in your document where you could 'naturally' put a `\clearpage` command? If so, do: the backlog of floats is cleared after a `\clearpage`. (Note that the `\chapter` command in the standard *book* and *report* classes implicitly executes `\clearpage`, so you can't float past the end of a chapter.)
- Try the *placeins* package: it defines a `\FloatBarrier` command beyond which floats may not pass. A package option allows you to declare that floats may not pass a `\section` command, but you can place `\FloatBarriers` wherever you choose.
- Have a look at the L^AT_EX 2_ε *afterpage* package. Its documentation gives as an example the idea of putting `\clearpage` *after* the current page (where it will clear the backlog, but not cause an ugly gap in your text), but also admits that the package is somewhat fragile. Use it as a last resort if the other two possibilities below don't help.
- If you would actually *like* great blocks of floats at the end of each of your chapters, try the *morefloats* package; this 'simply' increases the number of floating inserts that L^AT_EX can handle at one time (from 18 to 36).
- If you actually *wanted* all your figures to float to the end (*e.g.*, for submitting a draft copy of a paper), don't rely on L^AT_EX's mechanism: get the *endfloat* package to do the job for you.

afterpage.sty: Distributed as part of
 macros/latex/required/tools

endfloat.sty: macros/latex/contrib/supported/
 endfloat

float.sty: macros/latex/contrib/supported/float

morefloats.sty: macros/latex/contrib/other/
 misc/morefloats.sty

placeins.sty: macros/latex/contrib/other/misc/
 placeins.sty

205 Underlined text won't break

Knuth made no provision for underlining text: he took the view that underlining is not a typesetting operation, but rather one that provides emphasis on typewriters, which typically offer but one typeface. The corresponding technique in typeset text is to switch from upright to italic text (or vice-versa): the L^AT_EX command `\emph` does just that to its argument.

Nevertheless, typographically illiterate people (such as those that specify double-spaced thesis styles — see question 127) continue to require underlining of us, so L^AT_EX

as distributed defines an `\underline` command that applies the mathematical ‘underbar’ operation to text. This technique is not entirely satisfactory, however: the text gets stuck into a box, and won’t break at line end.

Two packages are available that solve this problem. The *ulem* package redefines the `\emph` command to underline its argument; the underlined text thus produced behaves as ordinary emphasised text, and will break over the end of a line. (The package is capable of other peculiar effects, too: read its documentation, contained within the file itself.) The *soul* package defines an `\ul` command (after which the package is, in part, named) that underlines running text.

ulem.sty: macros/latex/contrib/other/misc/ulem.sty

soul.sty: macros/latex/contrib/supported/soul

206 Controlling widows and orphans

Widows (the last line of a paragraph at the start of a page) and orphans (the first line of paragraph at the end of a page) interrupt the reader’s flow, and are generally considered “bad form”; (L^A)T_EX takes some precautions to avoid them, but completely automatic prevention is often impossible. If you are typesetting your own text, consider whether you can bring yourself to change the wording slightly so that the page break will fall differently.

The page maker, when forming a page, takes account of `\widowpenalty` and `\clubpenalty` (which relates to orphans!). These penalties are usually set to the moderate value of 150; this offers mild discouragement of bad breaks. You can increase the values by saying (for example) `\widowpenalty=500`; however, vertical lists (such as pages are made of) typically have rather little stretchability or shrinkability, so if the page maker has to balance the effect of stretching the unstretchable and being penalised, the penalty will seldom win. This dichotomy can be avoided by allowing the pagemaker to run pages short, by using the `\raggedbottom` directive; however, many publishers insist on the default `\flushbottom`; it is seldom acceptable to introduce stretchability into the vertical list, except at points (such as section headings) where the document design explicitly permits it.

Once you’ve exhausted the automatic measures, and have a final draft you want to “polish”, you have to indulge in manual measures. To get rid of an orphan is simple: precede the paragraph with `\clearpage` and the paragraph can’t start in the wrong place.

Getting rid of a widow can be more tricky. If the paragraph is a long one, it may be possible to set it ‘tight’: say `\looseness=-1` immediately after the last word of the paragraph. If that doesn’t work, try adjusting the page size: `\enlargethispage{\baselineskip}` may do the job, and get the whole paragraph on one page. Reducing the size of the page by `\enlargethispage{-\baselineskip}` may produce a (more-or-less) acceptable “two-line widow”. (Note: `\looseness=1`, increasing the line length by one, seldom seems to work — the looser paragraph typically has a one-word final line, which doesn’t look much better than the straight widow.)

T.3 Things have “gone away”

207 Old L^AT_EX font references such as `\tenrm`

L^AT_EX 2.09 defined a large set of commands for access to the fonts that it had built in to itself. For example, various flavours of *cmr* could be found as `\fivrm`, `\sixrm`, `\sevrn`, `\egtrm`, `\ninrm`, `\tenrm`, `\elvrn`, `\twlrm`, `\frtrnrm`, `\svtrnrm`, `\twtyrm` and `\twfvrn`. These commands were never documented, but certain packages nevertheless used them to achieve effects they needed.

Since the commands weren’t public, they weren’t included in L^AT_EX 2_ε; to use the unconverted L^AT_EX 2.09 packages under L^AT_EX 2_ε, you need also to include the *rawfonts* package (which is part of the L^AT_EX 2_ε distribution).

208 Missing symbol commands

You’re processing an old document, and some symbol commands such as `\Box` and `\lhd` appear no longer to exist. These commands were present in the core of L^AT_EX 2.09, but are not in current L^AT_EX. They are available in the *latsym* package (which is part of the L^AT_EX distribution), and in the *amsfonts* package (which is part of the AMS distribution, and requires AMS symbol fonts).

amsfonts.sty: fonts/amsfonts/latex

AMS symbol fonts: fonts/amsfonts/sources/symbols

209 Where are the *msx* and *msy* fonts?

The *msx* and *msy* fonts were designed by the American Mathematical Society in the very early days of T_EX, for use in typesetting papers for mathematical journals. They were designed using the ‘old’ METAFONT, which wasn’t portable and is no longer available; for a long time they were only available in 300dpi versions which only imperfectly matched modern printers. The AMS has now redesigned the fonts, using the current version of METAFONT, and the new versions are called the *msa* and *msb* families.

Nevertheless, *msx* and *msy* continue to turn up to plague us. There are, of course, still sites that haven’t got around to upgrading; but, even if everyone upgraded, there would still be the problem of old documents that specify them.

If you have a `.tex` source that requests *msx* and *msy*, the best technique is to edit it so that it requests *msa* and *msb* (you only need to change the single letter in the font names).

If you have a DVI file that requests the fonts, there is a package of virtual fonts (see question 37) to map the old to the new series.

msa and msb fonts: fonts/amsfonts/sources/symbols

virtual font set: fonts/vf-files/msx2msa

210 Where are the *am* fonts?

One *still* occasionally comes across a request for the *am* series of fonts. The initials stood for ‘Almost [Computer]

Modern', and they were the predecessors of the Computer Modern fonts that we all know and love (or hate)⁷. There's not a lot one can do with these fonts; they are (as their name implies) almost (but not quite) the same as the `cm` series; if you're faced with a document that requests them, all you can reasonably do is to edit the document. The appearance of DVI files that request them is sufficiently rare that no-one has undertaken the mammoth task of creating a translation of them by means of virtual fonts; however, most drivers let you have a configuration file in which you can specify font substitutions. If you specify that every `am` font should be replaced by its corresponding `cm` font, the output should be almost correct.

U Why does it *do* that?

U.1 Common errors

211 L^AT_EX gets cross-references wrong

Sometimes, however many times you run L^AT_EX, the cross-references are just wrong. Remember that the `\label` command must come *after* the `\caption` command, or be part of it. For example,

```
\begin{figure}          \begin{figure}
\caption{A Figure} or  \caption{A Figure%
\label{fig}             \label{fig}}
\end{figure}          \end{figure}
```

212 Start of line goes awry

This answer concerns two sorts of problems: errors of the form

```
! Missing number, treated as zero.
<to be read again>
```

g

```
<*> [grump]
```

and those where a single asterisk at the start of a line mysteriously fails to appear in the output.

Both problems arise because `\` takes optional arguments. The command `*` means “break the line here, and inhibit page break following the line break”; the command `\[dimen]` means “break the line here and add *dimen* extra vertical space afterwards”.

So why does `\` get confused by these things at the start of a line? It's looking for the first non-blank thing, and in the test it uses ignores the end of the line in your input text.

The solution is to enclose the stuff at the start of the new line in braces:

```
{\ttfamily
/* C-language comment\
{[grump]} I don't like this format\
{*/}
}
```

(The above text derives from an actual post to `comp.text.tex`; this particular bit of typesetting could plainly also be done using the `verbatim` environment.)

The problem also appears in maths mode, in arrays and so on. In this case, large-scale bracketing of things is *not* a good idea; the T_EX primitive `\relax` (which does nothing except to block searches of this nature) may be used. From another `comp.text.tex` example:

```
\begin{eqnarray}
[a] &=& b \\
\relax[a] &=& b
\end{eqnarray}
```

213 Why doesn't `\verb` work within...?

The L^AT_EX verbatim commands work by changing category codes. Knuth says of this sort of thing “Some care is needed to get the timing right...”, since once the category code has been assigned to a character, it doesn't change. So `\verb` has to assume that it is getting the first look at its parameter text; if it isn't, T_EX has already assigned category codes so that `\verb` doesn't have a chance. For example:

```
\verb+\error+
```

will work (typesetting ‘`\error`’), but

```
\newcommand{\unbrace}[1]{#1}
\unbrace{\verb+\error+}
```

will not (it will attempt to execute `\error`). Other errors one may encounter are ‘`\verb` ended by end of line’, or even ‘`\verb` illegal in command argument’.

This is why the L^AT_EX book insists that verbatim commands must not appear in the argument of any other command; they aren't just fragile, they're quite unusable in any command parameter, regardless of `\protection` (see question 192).

The first question to ask yourself is: “is `\verb` actually necessary?”

- If `\texttt{your text}` produces the same result as `\verb+your text+`, then there's no need of `\verb` in the first place.
- If you're using `\verb` to typeset a URL or email address or the like, then the `\url` command from the `url` package will help: it doesn't suffer from the problems of `\verb`.
- If you're putting `\verb` into the argument of a boxing command (such as `\fbox`), consider using the `lrbox` environment:

```
\newsavebox{\mybox}
...
\begin{lrbox}{\mybox}
\verb!VerbatimStuff!
\end{lrbox}
\fbox{\usebox{\mybox}}
```

Otherwise, there are three partial solutions to the problem.

- The `fancyvrb` package defines a command `\VerbatimFootnotes`, which redefines the `\footnotetext` (and hence the `\footnote`) commands in such a way that you can include `\verb` commands in its argument. This approach could

⁷The fonts acquired their label ‘Almost’ following the realisation that their first implementation in METAFONT79 still wasn't quite right; Knuth's original intention had been that they were the final answer

in principle be extended to the arguments of other commands, but it can clash with other packages: for example, `\VerbatimFootnotes` interacts poorly with the `para` option to the `footmisc` package.

- The `fancyvrb` package defines a command `\SaveVerb`, with a corresponding `\UseVerb` command, that allow you to save and then to reuse the content of its argument; for details of this extremely powerful facility, see the package documentation. Rather simpler is the `verbdef` package, which defines a (robust) command which expands to the verbatim argument given.
- If you have a single character that is giving trouble (in its absence you could simply use `\texttt`), consider using `\string`. `\texttt{my\string_name}` typesets the same as `\verb+my_name+`, and will work in the argument of a command. It won't, however, work in a moving argument, and no amount of `\protection` (see question 192) will make it work in such a case.

`fancyvrb.sty`: `macros/latex/contrib/supported/fancyvrb`

`url.sty`: `macros/latex/contrib/other/misc/url.sty`

`verbdef.sty`: `macros/latex/contrib/other/misc/verbdef.sty`

214 No line here to end

The error

! LaTeX Error: There's no line here to end.

See the LaTeX manual or LaTeX Companion

... for explanation.

comes in reaction to you giving L^AT_EX a `\` command at a time when it's not expecting it. The commonest case is where you've decided you want the label of a list item to be on a line of its own, so you've written (for example):

```
\begin{description}
\item[Very long label] \
Text...
\end{description}
```

`\` is actually a rather bad command to use in this case (even if it worked), since it would force the 'paragraph' that's made up of the text of the item to terminate a line which has nothing on it but the label. This would lead to an "Underfull `\hbox`" warning message (usually with 'infinite' badness of 10000); while this message doesn't do any actual harm other than slowing down your L^AT_EX run, any message that doesn't convey any information distracts for no useful purpose.

The proper solution to the problem is to write a new sort of `description` environment, that does just what you're after. (The *L^AT_EX Companion* — see question 22 — offers a rather wide selection of variants of these things.)

The quick-and-easy solution, which avoids the warning, is to write:

```
\begin{description}
\item[Very long label] \hspace*{\fill} \
```

Text...

```
\end{description}
```

which fills out the under-full line before forcing its closure. The `expdlist` package provides the same functionality with its `\breaklabel` command, and `mdwlist` provides it via its `\desclabelstyle` command.

The other common occasion for the message is when you're using the `center` (or `flushleft` or `flushright`) environment, and have decided you need extra separation between lines in the environment:

```
\begin{center}
First (heading) line\
\
body of the centred text...
\end{center}
```

The solution here is plain: use the `\` command in the way it's supposed to be used, to provide more than just a single line break space. `\` takes an optional argument, which specifies how much extra space to add; the required effect in the text above can be had by saying:

```
\begin{center}
First (heading) line\[\baselineskip]
body of the centred text...
\end{center}
```

`expdlist.sty`: `macros/latex/contrib/supported/expdlist`

`mdwlist.sty`: Distributed as part of `macros/latex/contrib/supported/mdwtools`

U.2 Common misunderstandings

215 What's going on in my `\include` commands?

The original L^AT_EX provided the `\include` command to address the problem of long documents: with the relatively slow computers of the time, the companion `\includeonly` facility was a boon. With the vast increase in computer speed, `\includeonly` is less valuable (though it still has its place in some very large projects). Nevertheless, the facility is retained in current L^AT_EX, and causes some confusion to those who misunderstand it.

In order for `\includeonly` to work, `\include` makes a separate `.aux` file for each included file, and makes a 'checkpoint' of important parameters (such as page, figure, table and footnote numbers); as a direct result, it *must* clear the current page both before and after the `\include` command. What's more, this mechanism doesn't work if a `\include` command appears in a file that was `\included` itself: L^AT_EX diagnoses this as an error.

So, we can now answer the two commonest questions about `\include`:

- Why does L^AT_EX throw a page before and after `\include` commands?

Answer: because it has to. If you don't like it, replace the `\include` command with `\input` — you won't be able to use `\includeonly` any more, but you probably don't need it anyway, so don't worry.

- Why can't I nest `\included` files? — I always used to be able to under L^AT_EX 2.09.
Answer: in fact, you couldn't, even under L^AT_EX 2.09, but the failure wasn't diagnosed. However, since you were happy with the behaviour under L^AT_EX 2.09, replace the `\include` commands with `\input` commands (with `\clearpage` as appropriate).

216 Why does it ignore paragraph parameters?

When T_EX is laying out text, it doesn't work from word to word, or from line to line; the smallest complete unit it formats is the paragraph. The paragraph is laid down in a buffer, as it appears, and isn't touched further until the end-paragraph marker is processed. It's at this point that the paragraph parameters have effect; and it's because of this sequence that one often makes mistakes that lead to the paragraph parameters not doing what one would have hoped (or expected).

Consider the following sequence of L^AT_EX:

```
{\raggedright % declaration for ragged text
Here's text to be ranged left in our output,
but it's the only such paragraph, so we now
end the group.}
```

Here's more that needn't be ragged...

T_EX will open a group, and set the ragged-setting parameters within that group; it will then save a couple of sentences of text and close the group (thus restoring the previous value of the ragged-setting parameters). Then it encounters a blank line, which it knows to treat as a `\par` token, so it typesets the two sentences; but because the enclosing group has now been closed, the parameter settings have been lost, and the paragraph will be typeset normally.

The solution is simple: close the paragraph inside the group, so that the setting parameters remain in place. An appropriate way of doing that is to replace the last three lines above with:

```
end the group.\par}
Here's more that needn't be ragged...
```

In this way, the paragraph is completed while the setting parameters are still in force within the enclosing group.

Another alternative is to define an environment that does the appropriate job for you. For the above example, L^AT_EX already defines an appropriate one:

```
\begin{flushleft}
Here's text to be ranged left...
\end{flushleft}
```

217 Case-changing oddities

T_EX provides two primitive commands `\uppercase` and `\lowercase` to change the case of text; they're not much used, but are capable creating confusion.

The two commands do not expand the text that is their parameter — the result of `\uppercase{abc}` is 'ABC', but `\uppercase{\abc}` is always '\abc', whatever the meaning of `\abc`. The commands are simply interpreting a table of equivalences between upper- and lower-case characters. They have (for example) no mathematical sense, and

```
\uppercase{About $y=f(x)$}
```

will produce

```
ABOUT $Y=F(X)$
```

which is probably not what is wanted.

In addition, `\uppercase` and `\lowercase` do not deal very well with non-American characters, for example `\uppercase{\ae}` is the same as `\ae`.

L^AT_EX provides commands `\MakeUppercase` and `\MakeLowercase` which fixes the latter problem. These commands are used in the standard classes to produce upper case running heads for chapters and sections.

Unfortunately `\MakeUppercase` and `\MakeLowercase` do not solve the other problems with `\uppercase`, so for example a section title containing `\begin{tabular} ... \end{tabular}` will produce a running head containing `\begin{TABULAR}`. The simplest solution to this problem is using a user-defined command, for example:

```
\newcommand{\mytable}{\begin{tabular}...
\end{tabular}}
\section{A section title \protect\mytable}
with a table}
```

Note that `\mytable` has to be protected, otherwise it will be expanded and made upper case; you can achieve the same result by declaring it with `\DeclareRobustCommand`, in which case the `\protect` won't be necessary.

David Carlisle's *textcase* package addresses many of these problems in a transparent way. It defines commands `\MakeTextUppercase` and `\MakeTextLowercase` which do upper- or lowercase, with the fancier features of the L^AT_EX standard `\Make*`-commands but without the problems mentioned above. Load the package with `\usepackage[overload]{textcase}`, and it will redefine the standard commands, so that section headings and the like don't produce broken page headings.

textcase.sty: Distributed as part of
macros/latex/contrib/supported/carlisle

218 Why does L^AT_EX split footnotes across pages?

L^AT_EX splits footnotes when it can think of nothing better to do. Typically, when this happens, the footnote mark is at the bottom of the page, and the complete footnote would overflow the page. L^AT_EX could try to salvage this problem by making the page short of both the footnote and the line with the footnote mark, but its priorities told it that splitting the footnote would be preferable.

As always, the best solution is to change your text so that the problem doesn't occur in the first place. Consider whether the text that bears the footnote could move earlier in the current page, or on to the next page.

If this isn't possible, you might want to change L^AT_EX's perception of its priorities: they're controlled by `\interfootnotelinepenalty` — the larger it is, the less willing L^AT_EX is to split footnotes.

Setting

```
\interfootnotelinepenalty=10000
```

inhibits split footnotes altogether, which will cause 'Underfull \vbox' messages unless you also specify

`\raggedbottom`. The default value of the penalty is 100, which is rather mild.

An alternative technique is to juggle with the actual size of the pages. `\enlargethispage` changes the size of the current page by its argument (for example, you might say `\enlargethispage{\baselineskip}` to add a single line to the page, but you can use any ordinary \TeX length such as 15mm or -20pt as argument). Reducing the size of the current page could force the offending text to the next page; increasing the size of the page may allow the footnote to be included in its entirety. It may be necessary to change the size of more than one page.

219 Getting `\marginpar` on the right side

In `twoside` documents, \LaTeX makes sterling attempts to put `\marginpars` in the correct margin (the outer or the gutter margin, according to the user's command). However, a booby-trap arises because \TeX runs its page maker asynchronously. If a `\marginpar` is processed while page n is being built, but doesn't get used until page $n+1$, then the `\marginpar` will turn up on the wrong side of the page. This is an instance of a general problem: see question 196.

The solution to the problem is for \LaTeX to 'remember' which side of the page each `\marginpar` should be on. The `mparhack` package does this, using marks stored in the `.aux` file.

```
mparhack.sty: macros/latex/contrib/supported/  
mparhack
```

220 Where have my characters gone?

You've typed some apparently reasonable text and processed it, but the result contains no sign of some of the characters you typed. A likely reason is that the font you selected just doesn't have a representation for the character in question.

For example, if I type "that will be £44.00" into an ordinary (\LaTeX) document, or if I select the font `rsfs10` (which contains uppercase letters only) and type pretty much anything, the £ sign, or any lowercase letters or digits will not appear in the output. There's no actual error message, either: you have to read the log file, where you'll find cryptic little messages like

Missing character:

```
There is no ^^a3 in font cmr10!
```

Missing character:

```
There is no 3 in font rsfs10!
```

(the former demonstrating my \TeX 's unwillingness to deal in characters which have the eighth bit set, while the `rsfs10` example shows that \TeX will log the actual character in error, if it thinks it's possible).

Somewhat more understandable are the diagnostics you may get from `dvips` when using the OT1 and T1 versions of fonts that were supplied in Adobe standard encoding:

```
dvips: Warning: missing glyph 'Delta'
```

The process that generates the metrics for using the fonts generates an instruction to `dvips` to produce these diagnostics, so that their non-appearance in the printed output is less surprising than it might be. Quite a few glyphs

available in Knuth's text encodings and in the Cork encoding are not available in the Adobe fonts. In these cases, there *is* a typeset sign of the character: `dvips` produces a black rectangle of whatever size the concocted font file has specified.

221 "Rerun" messages won't go away

The \LaTeX message "Rerun to get crossreferences right" is supposed to warn the user that his job needs to be processed again, since labels seem to have changed since the previous run. (\LaTeX compares the labels it's created this time round with what it found from the previous run when it started; it does this comparison at `\end{document}`.)

Sometimes, the message won't go away: however often you reprocess your document, \LaTeX still tells you that "Label(s) may have changed". This can sometimes be caused by a broken package: both `footmisc` (with the `perpage` option) and `hyperref` have been known to give trouble, in the past: if you are using either, check you have the latest version, and upgrade if possible.

However, there *is* a rare occasion when this error can happen as a result of pathological structure of the document itself. Suppose you have pages numbered in roman, and you add a reference to a label on page "ix" (9). The presence of the reference pushes the thing referred to onto page "x" (10), but since that's a shorter reference the label moves back to page "ix" at the next run. Such a sequence can obviously not terminate.

The only solution to this problem is to make a small change to your document (something as small as adding or deleting a comma will often be enough).

```
footmisc.sty: macros/latex/contrib/supported/  
footmisc
```

```
hyperref.sty: macros/latex/contrib/supported/  
hyperref
```

222 Commands gobble following space

People are forever surprised that simple commands gobble the space after them: this is just the way it is. The effect arises from the way \TeX works, and Lamport describes a solution (place a pair of braces after a command's invocation) in the description of \LaTeX syntax. Thus the requirement is in effect part of the definition of \LaTeX .

This FAQ, for example, is written with definitions that *require* one to type `\fred{}` for almost all macro invocations, regardless of whether the following space is required: however, this FAQ is written by highly dedicated (and, some would say, eccentric) people. Many users find all those braces become very tedious very quickly, and would really rather not type them all.

An alternative structure, that doesn't violate the design of \LaTeX , is to say `\fred\` — the `\` command is "self terminating" (like `\`) and you don't need braces after it. Thus one can reduce to one the extra characters one needs to type.

If even that one character is too many, the package `xspace` defines a command `\xspace` that guesses whether there should have been a space after it, and if so introduces that space. So `"fred\xspace jim"` produces "fred jim", while `"fred\xspace. jim"` produces "fred. jim".

Which usage would of course be completely pointless; but you can incorporate `\xspace` in your own macros:

```
\usepackage{xspace}
...
\newcommand{\restenergy}%
    {\ensuremath{mc^2}\xspace}
...
```

and we find `\restenergy` available to us...

The `\xspace` command must be the last thing in your macro definition (as in the example); it's not completely foolproof, but it copes with most obvious situations in running text.

The *xspace* package doesn't save you anything if you only use a modified macro once or twice within your document, and in any case be careful with usage of `\xspace` — it offers a change in your input syntax which can be confusing, particularly if you retain some commands which don't use it. (Of course, any command built into \LaTeX or into any class or package you use won't use `\xspace`: you need to think every time you use such a command.) And of course, be careful to explain what you're doing to any collaborating author!

xspace.sty: Distributed as part of
`macros/latex/required/tools`

223 \LaTeX makes overfull lines

When \TeX is building a paragraph, it can make several attempts to get the line-breaking right; on each attempt it runs the same algorithm, but gives it different parameters. You can affect the way \TeX 's line breaking works by adjusting the parameters: this answer deals with the “tolerance” and stretchability parameters. The other vital ‘parameter’ is the set of hyphenations to be applied: see question 170 (and the questions it references) for advice.

If you're getting an undesired “overfull box”, what has happened is that \TeX has given up: the parameters you gave it don't allow it to produce a result that *doesn't* overfill. In this circumstance, Knuth decided the best thing to do was to produce a warning, and to allow the user to solve the problem. (The alternative, silently to go beyond the envelope of “good taste” defined for this run of \TeX , would be distasteful to any discerning typographer.) The user can almost always address the problem by rewriting the text that's provoking the problem — but that's not always possible, and in some cases it's impossible to solve the problem without adjusting the parameters. This answer discusses the approaches one might take to resolution of the problem, on the assumption that you've got the hyphenation correct.

The simplest case is where a ‘small’ word fails to break at the end of a line; pushing the entire word to a new line isn't going to make much difference, but it might make things just bad enough that \TeX won't do it by default. In such a case one can *try* the \LaTeX `\linebreak` command: it may solve the problem, and if it does, it will save an awful lot of fiddling. Otherwise, one needs to adjust parameters: to do that we need to recap the details of \TeX 's line breaking mechanisms.

\TeX 's first attempt at breaking lines is performed without even trying hyphenation: \TeX sets its “tol-

erance” of line breaking oddities to the internal value `\pretolerance`, and sees what happens. If it can't get an acceptable break, \TeX adds the hyphenation points allowed by the current patterns, and tries again using the internal `\tolerance` value. If this pass also fails, and the internal `\emergencystretch` value is positive, \TeX will try a pass that allows `\emergencystretch` worth of extra stretchability to the spaces in each line.

In principle, therefore, there are three parameters (other than hyphenation) that you can change: `\pretolerance`, `\tolerance` and `\emergencystretch`. Both the `tolerance` values are simple numbers, and should be set by \TeX primitive count assignment — for example

```
\pretolerance=150
```

For both, an “infinite” tolerance is represented by the value 10 000, but infinite tolerance is rarely appropriate, since it can lead to very bad line breaks indeed.

`\emergencystretch` is a \TeX -internal ‘dimen’ register, and can be set as normal for dimens in Plain \TeX ; in \LaTeX , use `\setlength` — for example:

```
\setlength{\emergencystretch}{3em}
```

The the choice of method has time implications — each of the passes takes time, so adding a pass (by changing `\emergencystretch`) is less desirable than suppressing one (by changing `\pretolerance`). However, it's unusual nowadays to find a computer that's slow enough that the extra passes are really troublesome.

In practice, `\pretolerance` is rarely used other than to manipulate the use of hyphenation; Plain \TeX and \LaTeX both set its value to 100. To suppress the first scan of paragraphs, set `\pretolerance` to -1.

`\tolerance` is often a good method for adjusting spacing; Plain \TeX and \LaTeX both set its value to 200. \LaTeX 's `\sloppy` command sets it to 9999, as does the `sloppy` environment. This value is the largest available, this side of infinity, and can allow pretty poor-looking breaks (this author rarely uses `\sloppy` “bare”, though he does occasionally use `sloppy` — that way, the change of `\tolerance` is confined to the environment). More satisfactory is to make small changes to `\tolerance`, incrementally, and then to look to see how the change affects the result; very small increases can often do what's necessary. Remember that `\tolerance` is a paragraph parameter, so you need to ensure it's actually applied — see question 216. \LaTeX users could use an environment like:

```
\newenvironment{tolerant}[1]{%
    \par\tolerance=#1\relax
}{%
    \par
}
```

enclosing entire paragraphs (or set of paragraphs) in it.

`\emergencystretch` is a slightly trickier customer to understand. The example above set it to `3em`; the Computer Modern fonts ordinarily fit three space skips to the em, so the change would allow anything up to the equivalent of nine extra spaces in each line. In a line with lots of spaces, this could be reasonable, but with (say) only

three spaces on the line, each could stretch to four times its natural width.

V The joy of \TeX errors

224 How to approach errors

Since \TeX is a macroprocessor, its error messages are often difficult to understand; this is a (seemingly invariant) property of macroprocessors. Knuth makes light of the problem in the \TeX book, suggesting that you acquire the sleuthing skills of a latter-day Sherlock Holmes; while this approach has a certain romantic charm to it, it's not good for the 'production' user of (\LaTeX) \TeX . This answer (derived, in part, from an article by Sebastian Rahtz in *TUGboat* 16(4)) offers some general guidance in dealing with \TeX error reports, and other answers in this section deal with common (but perplexing) errors that you may encounter. There's a long list of "hints" in Sebastian's article, including the following:

- Look at \TeX errors; those messages may seem cryptic at first, but they often contain a straightforward clue to the problem. See question 225 for further details.
- Read the `.log` file; it contains hints to things you may not understand, often things that have not even presented as error messages.
- Be aware of the amount of context that \TeX gives you. The error messages gives you some bits of \TeX code (or of the document itself), that show where the error "actually happened"; it's possible to control how much of this 'context' \TeX actually gives you. \LaTeX (nowadays) instructs \TeX only to give you one line of context, but you may tell it otherwise by saying

```
\setcounter{errorcontextlines}{999}
```

in the preamble of your document. (If you're not a confident macro programmer, don't be ashamed of cutting that 999 down a bit; some errors will go on and on, and spotting the differences between those lines can be a significant challenge.)

- As a last resort, tracing can be a useful tool; reading a full (\LaTeX) \TeX trace takes a strong constitution, but once you know how, the trace can lead you quickly to the source of a problem. You need to have read the \TeX book (see question 22) in some detail, fully to understand the trace.

The command `\tracingall` sets up maximum tracing; it also sets the output to come to the interactive terminal, which is somewhat of a mixed blessing (since the output tends to be so vast — all but the simplest traces are best examined in a text editor after the event).

The \LaTeX *trace* package (first distributed with the 2001 release of \LaTeX) provides more manageable tracing. Its `\traceon` command gives you what `\tracingall` offers, but suppresses tracing around some of the truly verbose parts of \LaTeX itself. The package also provides a `\traceoff` command (there's no "off" command for `\tracingall`), and

a package option (`logonly`) allows you to suppress output to the terminal.

The best advice to those faced with \TeX errors is not to panic: most of the common errors are plain to the eye when you go back to the source line that \TeX tells you of. If that approach doesn't work, the remaining answers in this section deal with some of the odder error messages you may encounter. You should not ordinarily need to appeal to the wider public (question 25) for assistance, but if you do, be sure to report full backtraces (see `errorcontextlines` above) and so on.

trace.sty: Distributed as part of
macros/latex/required/tools

225 The structure of \TeX error messages

\TeX 's error messages are reminiscent of the time when \TeX itself was conceived (the 1970s): they're not terribly user-friendly, though they do contain all the information that \TeX can offer, usually in a pretty concise way.

\TeX 's error reports all have the same structure:

- An error message
- Some 'context'
- An error prompt

The error message will relate to the \TeX condition that is causing a problem. Sadly, in the case of complex macro packages such as \LaTeX , the underlying \TeX problem may be superficially difficult to relate to the actual problem in the "higher-level" macros. Many \LaTeX -detected problems manifest themselves as 'generic' errors, with error text provided by \LaTeX itself (or by a \LaTeX class or package).

The context of the error is a stylised representation of what \TeX was doing at the point that it detected the error. As noted in question 224, a macro package can tell \TeX how much context to display, and the user may need to undo what the package has done. Each line of context is split at the point of the error; if the error *actually* occurred in a macro called from the present line, the break is at the point of the call. (If the called object is defined with arguments, the "point of call" is after all the arguments have been scanned.) For example:

```
\blah and so on
produces the error report
! Undefined control sequence.
1.4 \blah
      and so on

while:
\newcommand{\blah}[1]{\bleah #1}
\blah{to you}, folks
produces the error report
! Undefined control sequence.
\blah #1->\bleah
      #1
1.5 \blah{to you}
      , folks
```

If the argument itself is in error, we will see things such as

```
\newcommand{\blah}[1]{#1 to you}
\blah{\bleah}, folks
```

producing

! Undefined control sequence.

<argument> \bleah

1.5 \blah{\bleah}

, folks

The prompt accepts single-character commands: the list of what's available may be had by typing ?. One immediately valuable command is `h`, which gives you an expansion of T_EX's original `précis` message, sometimes accompanied by a hint on what to do to work round the problem in the short term. If you simply type 'return' (or whatever else your system uses to signal the end of a line) at the prompt, T_EX will attempt to carry on (often with rather little success).

226 An extra '}'??

You've looked at your L^AT_EX source and there's no sign of a misplaced } on the line in question.

Well, no: this is T_EX's cryptic way of hinting that you've put a fragile command in a moving argument (see question 192).

For example, `\footnote` is fragile, and if we put that in the moving argument of a `\section` command, as

```
\section{Mumble\footnote{%
  I couldn't think of anything better}}
```

we get told

```
! Argument of \@sect has an extra }.
```

The solution is usually to use a robust command in place of the one you are using, or to force your command to be robust by prefixing it with `\protect`, which in the above case would show as

```
\section{Mumble\protect\footnote{%
  I couldn't think of anything better}}
```

Note that, in some cases, simple `\protection` is *not* the answer; question 161 deals specifically with this case.

227 Capacity exceeded [semantic nest...]

```
! TeX capacity exceeded, sorry [semantic nest
                                size=100].
```

...

If you really absolutely need more capacity, you can ask a wizard to enlarge me.

Even though T_EX suggests (as always) that enlargement by a wizard may help, this message usually results from a broken macro or bad parameters to an otherwise working macro.

The "semantic nest" T_EX talks about is the nesting of boxes within boxes. A stupid macro can provoke the error pretty easily:

```
\def\silly{\hbox{here's \silly being executed}}
\silly
```

The extended traceback (see question 224) *does* help, though it does rather run on. In the case above, the traceback consists of

```
\silly ->\hbox {
                here's \silly being executed}
```

followed by 100 instances of

```
\silly ->\hbox {here's \silly
                                being executed}
```

The repeated lines are broken at exactly the offending macro; of course the loop need not be as simple as this — if `\silly` calls `\dopy` which boxes `\silly`, the effect is just the same and alternate lines in the traceback are broken at alternate positions.

228 No room for a new 'thing'

The technology available to Knuth at the time T_EX was written is said to have been particularly poor at managing dynamic storage; as a result much of the storage used within T_EX is allocated as fixed arrays, in the reference implementations. Many of these fixed arrays are expandable in modern T_EX implementations, but size of the arrays of "registers" is written into the specification as being 256 (usually); this number may not be changed if you still wish to call the result T_EX (see question 5).

If you fill up one of these register arrays, you get a T_EX error message saying

```
! No room for a new \<thing>.
```

The `\things` in question may be `\count` (the object underlying L^AT_EX's `\newcounter` command), `\skip` (the object underlying L^AT_EX's `\newlength` command), `\box` (the object underlying L^AT_EX's `\newsavebox` command), or `\dimen`, `\muskip`, `\toks`, `\read`, `\write` or `\language` (all types of object whose use is "hidden" in L^AT_EX; the limit on the number of `\read` or `\write` objects is just 16).

There is nothing that can directly be done about this error, as you can't extend the number of available registers without extending T_EX itself. (Of course, Ω and ε -T_EX — see questions 236 and 237 respectively — both do this, as does MicroPress Inc's V_TE_X — see question 55.)

The commonest way to encounter one of these error messages is to have broken macros of some sort, or incorrect usage of macros (an example is discussed in question 229). However, sometimes one just *needs* more than T_EX can offer, and when this happens, you've just got to work out a different way of doing things. An example is the difficulty of loading P₁C_TE_X with L^AT_EX (see question 203).

229 epsf gives up after a bit

Some copies of the documentation of `epsf.tex` seem to suggest that the command

```
\input epsf
```

is needed for every figure included. If you follow this suggestion too literally, you get an error

```
! No room for a new \read .
```

after a while; this is because each time `epsf.tex` is loaded, it allocates itself a *new* file-reading handle to check the figure for its bounding box, and there just aren't enough of these things (see question 228).

The solution is simple — this is in fact an example of misuse of macros; one only need read `epsf.tex` once, so change

```
...
\input epsf
\epsffile{...}
```

```
...
\input epsf
\epsffile{...}

```

(and so on) with a single

```
\input epsf
```

somewhere near the start of your document, and then decorate your `\epsffile` statements with no more than adjustments of `\epsfxsize` and so on.

230 Improper `\hyphenation` will be flushed

For example

```
! Improper \hyphenation will be flushed.
\’#1->{
  \accent 19 #1}
<*> \hyphenation{Ji-m\’e
      -nez}

```

(in Plain \TeX) or

```
! Improper \hyphenation will be flushed.
\leavevmode ->\unhbox
      \voidb@x
<*> \hyphenation{Ji-m\’e
      -nez}

```

in \LaTeX .

As mentioned in question 170, words with accents in them may not be hyphenated. As a result, any such word is deemed improper in a `\hyphenation` command.

The solution is to use a font that contains the character in question, and to express the `\hyphenation` command in terms of that character; this “hides” the accent from the hyphenation mechanisms. \LaTeX users can be achieved this by use of the *fontenc* package (part of the \LaTeX distribution). If you select an 8-bit font with the package, as in `\usepackage[T1]{fontenc}`, accented-letter commands such as the `\’e` in `\hyphenation{Ji-m\’e-nez}` automatically become the single accented character by the time the hyphenation gets a to look at it.

231 “Too many unprocessed floats”

If \LaTeX responds to a `\begin{figure}` or `\begin{table}` command with the error message

```
! LaTeX Error: Too many unprocessed floats.
```

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

your figures (or tables) are failing to be placed properly. \LaTeX has a limited amount of storage for ‘floats’ (figures, tables, or floats you’ve defined yourself with the *float* package); if you don’t let it ever actually typeset any floats, it will run out of space.

This failure usually occurs in extreme cases of floats moving “wrongly” (see question 204); \LaTeX has found it can’t place a float, and floats of the same type have piled up behind it. \LaTeX ’s idea is to ensure that caption numbers are sequential in the document: the caption number is allocated when the figure (or whatever) is created, and can’t be changed, so that placement out of order would mean figure numbers appearing out of order in the document (and in the list of figures, or whatever). So a simple

failure to place a figure means that no subsequent figure can be placed; and hence (eventually) the error.

Techniques for solving the problem are discussed in the floats question (204) already referenced.

The error also occurs in a long sequence of `figure` or `table` environments, with no intervening text. Unless the environments will fit “here” (and you’ve allowed them to go “here”), there will never be a page break, and so there will never be an opportunity for \LaTeX to reconsider placement. (Of course, the floats can’t all fit “here” if the sequence is sufficiently prolonged: once the page fills, \LaTeX won’t place any more floats. Techniques for resolution may involve redefining the floats using the *float* package’s [H] float qualifier, but you are unlikely to get away without using `\clearpage` from time to time.

```
float.sty: macros/latex/contrib/supported/float
```

232 `\spacefactor` complaints

The errors

```
! You can’t use ‘\spacefactor’ in vertical mode.
\@->\spacefactor
      \@m

```

or

```
! Improper \spacefactor.
```

...

come of using a \LaTeX internal command without taking the precaution of fooling \LaTeX that you’re inside it. The problem is discussed in detail in question 191, together with solutions.

233 `\end` occurred inside a group

The actual error we observe is:

```
(\end occurred inside a group at level <n>)
and it tells us that something we started in the document never got finished before we ended the document itself. The things involved (‘groups’) are what  $\TeX$  uses for restricting the scope of things: you see them, for example, in the “traditional” font selection commands: {\it stuff\} — if the closing brace is left off such a construct, the effect of \it will last to the end of the document, and you’ll get the diagnostic.
```

\TeX itself doesn’t tell you where your problem is, but you can often spot it by looking at the typeset output in a previewer. Otherwise, you can usually find mismatched braces using an intelligent editor (at least *emacs* and *winedt* offer this facility). However, groups are not *only* created by matching `{` with `}`: other grouping commands are discussed elsewhere in these FAQs, and are also a potential source of unclosed group.

`\begin{environment}` encloses the environment’s body in a group, and establishes its own diagnostic mechanism. If you end the document before closing some other environment, you get the ‘usual’ \LaTeX diagnostic

```
! LaTeX Error: \begin{blah} on input line 6
      ended by \end{document}.
```

which (though it doesn’t tell you which *file* the `\begin{blah}` was in) is usually enough to locate the immediate problem. If you press on past the \LaTeX error, you get the “occurred inside a group” message before \LaTeX finally exits.

In the absence of such information from \LaTeX , you need to use “traditional” binary search to find the offending group. Separate the header from the body of your file, and process each half on its own with the header; this tells you which half of the file is at fault. Divide again and repeat. The process needs to be conducted with care (it’s obviously possible to split a correctly-written group by chopping in the wrong place), but it will usually find the problem fairly quickly.

ε - \TeX (and *elateX* — \LaTeX run on ε - \TeX) gives you further diagnostics after the traditional infuriating \TeX one — it actually keeps the information in a similar way to \LaTeX :

```
(\end occurred inside a group at level 3)

### semi simple group (level 3) entered
                                at line 6 (\begingroup)
### simple group (level 2) entered at line 5 ({)
### simple group (level 1) entered at line 4 ({)
### bottom level
```

The diagnostic not only tells us where the group started, but also the *way* it started: `\begingroup` or `{` (which is an alias of `\bgroup`, and the two are not distinguishable at the \TeX -engine level).

234 “Missing number, treated as zero”

In general, this means you’ve tried to assign something to a count, dimension or skip register that isn’t (in \TeX ’s view of things) a number. Usually the problem will become clear using the ordinary techniques of examining errors (see question 224).

Two \LaTeX -specific errors are commonly aired on the newsgroups.

The first arises from a misconfiguration in a system that has been upgraded from \LaTeX 2.09: the document uses `\usepackage{times}`, and the error appears at `\begin{document}`: the likely cause is lurking files that remain from the \LaTeX 2.09 version of the *times* package. The *times* package in *psnfss* is a very simple beast, but the \LaTeX 2.09 version is quite complicated, and loads another package: this is clear in the log if you have been “bitten” this way. The resolution is to clear out all the old PostScript-related packages, and then to install *psnfss*.

The second arises from attempting to use an example describe in *The \LaTeX Companion* (see question 22), and is exemplified by the following error text:

```
! Missing number, treated as zero.
<to be read again>

                                \relax
```

```
1.21 \begin{Ventry}{Return values}
```

The problem arises because the *Companion*’s examples always assume that the *calc* package is loaded: this fact is mentioned in the book, but often not noticed. The remedy is to load the *calc* package in any document using such examples from the *Companion*.

```
calc.sty: Distributed as part of
          macros/latex/required/tools
```

```
The psnfss bundle: macros/latex/required/psnfss
```

W Current \TeX Projects

235 The \LaTeX 3 project

The \LaTeX 3 project team (see <http://www.latex-project.org/latex3.html>) is a small group of volunteers whose aim is to produce a major new document processing system based on the principles pioneered by Leslie Lamport in the current \LaTeX . It will remain freely available and it will be fully documented at all levels.

The \LaTeX 3 team’s first product (\LaTeX 2 ε) was delivered in 1994 (it’s now properly called “ \LaTeX ”, since no other version is current).

\LaTeX 2 ε was intended as a consolidation exercise, unifying several sub-variants of \LaTeX while changing nothing whose change wasn’t absolutely necessary. This has permitted the team to support a single version of \LaTeX , in parallel with development of \LaTeX 3.

Some of the older discussion papers about directions for \LaTeX 3 are to be found at info/ltx3pub; other (published) articles are to be found on the project web site (see <http://www.latex-project.org/articles.html>), as is some of the project’s experimental code (<http://www.latex-project.org/experimental>). You can participate in discussions of the future of \LaTeX through the mailing list `latex-1`. Subscribe to the list by sending a message ‘`subscribe latex-1 <your name>`’ to `listserv@urz.Uni-Heidelberg.de`

236 The Omega project

Omega (Ω) is a program built by extension of the \TeX sources which works internally with ‘wide’ characters (it is capable of dealing with all of Unicode version 3); this allows it to work with most scripts in the world with few difficulties from coding schemes. Ω also has a powerful concept of input and output filters to allow the user to work with existing transliteration schemes, *etc.*

An email discussion list is available: subscribe by sending a message ‘`subscribe`’ to `omega-request@omega.cse.unsw.edu.au`

Ω was first released in November 1996 by the project originators, John Plaice and Yannis Haralambous; a recent version is maintained on CTAN. However, Ω is now an open source project, and details of a *cvs* repository, as well as papers and other information, are available via the project’s web site (<http://omega.cse.unsw.edu.au>).

Implementations of Ω are available as part of the $\text{te}\TeX$, $\text{mik}\TeX$, $\text{fp}\TeX$ and $\text{C}\text{Mac}\TeX$ distributions (see question 53); Ω is also distributed on the \TeX Live CD-ROM (see question 52).

```
CTAN distribution: systems/omega
```

237 The $\mathcal{N}\mathcal{T}\mathcal{S}$ project

The $\mathcal{N}\mathcal{T}\mathcal{S}$ project was established in 1992, to produce a typesetting system that’s even better than \TeX . The project is not simply enhancing \TeX , for two reasons: first, that \TeX itself has been frozen by Knuth (see question 18), and second, even if they *were* allowed to develop the program, some members of the $\mathcal{N}\mathcal{T}\mathcal{S}$ team feel that \TeX in its present form is simply unsuited to further development. While all those involved in the project are committed to \TeX , they recognise that the end product

may very well have little in common with \TeX other than its philosophy.

The group's first product was nevertheless a set of extensions and enhancements to \TeX , implemented through the standard medium of a change-file. The extended system is known ε - \TeX , and is 100% compatible with \TeX ; furthermore, ε - \TeX can construct a format that *is* " \TeX ", with no extensions or enhancements present.

The most recent base source of ε - \TeX (i.e., the Web change file) is available on CTAN. Implementations of ε - \TeX are also distributed on the \TeX Live CD-ROM (see question 52), and with most other modern free \TeX distributions.

The project has now produced a β -version of \TeX written (from scratch) in Java. Since it *isn't* \TeX (it remains slightly incompatible in microscopic ways), it's known as $\mathcal{N}\mathcal{T}\mathcal{S}$. As might be expected, this first re-implementation runs rather slowly, but its operation *has* been demonstrated in public, and the β -release is available on CTAN.

e-TeX: Browse `systems/e-tex`

NTS: `systems/nts`

238 The PDF \TeX project

PDF \TeX (formerly known as \TeX 2PDF) arose from Han The Thanh's post-graduate research at Masaryk University, Brno, Czech Republic. The basic idea is very simple: to provide a version of \TeX that can output PDF as an alternative format to DVI. PDF \TeX implements a small number of new primitives, to switch to PDF output, and to control various PDF features. Han The Thanh has worked on PDF \TeX throughout his Ph.D. research into typesetting, and the latest release includes facilities written to support novel typesetting techniques.

The latest version of PDF \TeX is available on CTAN, and implementations are available as part the $\text{te}\TeX$, $\text{mik}\TeX$, $\text{fp}\TeX$, and $\text{CMac}\TeX$ distributions (see question 53); it is also distributed on the \TeX Live CD-ROM (see question 52). A version (by the author of $\text{CMac}\TeX$) for use with $\text{Oz}\TeX$ is also available on CTAN.

A mailing list discussing PDF \TeX is available; send a message containing (just) `subscribe pdftex` to `majordomo@tug.org` (you will be required to confirm your subscription).

pdftex: Browse `systems/pdftex`

pdftex for OzTeX: `nonfree/systems/mac/pdftex/pdftex_for_oztex.sit.bin`

239 Future WEB technologies and (\mathbb{A}) \TeX

An earlier question (69) addresses the issue of converting existing (\mathbb{A}) \TeX documents for viewing on the Web as HTML. All the present techniques are somewhat flawed: the answer explains why.

However, things are changing, with better font availability, cunning HTML programming and the support for new Web standards.

Font technologies Direct representation of mathematics in browsers has been hampered up to now by the limited range of symbols in the fonts one can rely

on being available. In the near future, we can expect rather wide availability of Unicode fonts with better coverage of symbols.

XML The core of the range of new standards is XML, which provides a framework for better structured markup; limited support for for it has already appeared in some browsers.

Conversion of (\mathbb{A}) \TeX source to XML is already available (through \TeX 4ht at least), and work continues in that arena. The alternative, authoring in XML (thus producing documents that are immediately Web-friendly, if not ready) and using (\mathbb{A}) \TeX to typeset is also well advanced. One useful technique is *transforming* the XML to $\mathbb{A}\TeX$, using XSLT, and then simply using $\mathbb{A}\TeX$; alternatively, one may typeset direct from the XML source (see question 70).

Direct representation of mathematics MathML is a standard for representing maths on the Web; its original version is distinctly limited, but efforts to give it greater richness (approaching that of \TeX) are under way. Browser support for MathML (e.g., in *amaya*, a version of the Netscape 'Open Source' browser *mozilla* and in specially extended versions of *Internet Explorer*) is becoming available. There's evidence that (\mathbb{A}) \TeX users are starting to use such browsers.

Work both the \TeX 4ht and *TtH* projects, to produce MathML is well advanced.

Graphics SVG is a standard for graphics representation on the web. While the natural use is for converting existing figures, representations of formulas are also possible, in place of the separate bitmaps that have been used in the past (and while we wait for the wide deployment of MathML).

Browser plug-ins, that deal with SVG are already available (Adobe offer one, for example).

240 The \TeX trace project

\TeX trace is a bundle of Unix scripts that use a free-ware boundary tracing package to generate Type 1 outline fonts from METAFONT bitmap font outputs. The result is unlikely ever to be of the quality of the commercially-produced Type 1 font, but there remain fonts which many people find useful and which fail to attract the paid experts.

The project was started by Peter Szabo, and its current state is available via the project's entry on Sourceforge (see <http://sourceforge.net/projects/textrace/>) and there are already a few sets of fonts on CTAN generated using \TeX trace: Peter Szabo's own EC/TC font set, Vladimir Volovich's CM-Super set, which covers the EC, TC, and the Cyrillic LH font sets, and Takanori Uchiyama's set of the Musix \TeX fonts.

A package that says it's "inspired" by \TeX trace is *pktrace*: this is a small *Python* program that does the same job — see <http://www.cs.ruu.nl/~hanwen/pktrace/>; it has not yet been used to generate fonts that have been installed on CTAN.

CM-Super fonts: `fonts/ps-type1/cm-super`

Type 1 versions of EC and TC fonts:

fonts/ps-type1/ec

musixtex fonts: fonts/musixtex/ps-type1/musixps-unix.tar.gz

X You're still stuck?

241 You don't understand the answer

While the FAQ maintainers don't offer a 'help' service, they're very keen that you understand the answers they've already written. They're (almost) written "in a vacuum", to provide something to cover a set of questions that have arisen; it's always possible that they're written in a way that a novice won't understand them.

Which is where you can help the community. Mail the maintainers (see <mailto:uktug-faq@tex.ac.uk>) to report the answer that you find unclear. Time permitting (the team is small and all its members are busy), we'll try and clarify the answer. This way, with a bit of luck, we can together improve the value of this resource to the whole community.

(We need hardly say that we look forward to hearing from none of you: but we're not so arrogant as to be confident that we won't!)

242 Submitting new material for the FAQ

The FAQ will never be complete, and we always expect that there will be people out there who know better than we do about something or other. We always need to be put right about whatever we've got wrong, and suggestions for improvements, particularly covering areas we've missed, are always needed: mail anything you have to the maintainers (see <mailto:uktug-faq@tex.ac.uk>).

If you have actual material to submit, your contribution is more than ever welcome. Submission in plain text is entirely acceptable, but if you're really willing, you may feel free to mark up your submission in the form needed for the FAQ itself. The markup is a strongly-constrained version of L^AT_EX — the constraints come from the need to translate the marked-up text to HTML on the fly (and hence pretty efficiently). There is a file `markup-syntax` in the FAQ distribution that describes the structure of the markup, but there's no real substitute for reading at least some of the source (`faqbody.tex`) of the FAQ itself. If you understand *perl*, you may also care to look at the translation code in `texfaq2html` in the distribution: this isn't (any longer) the program actually used on the Web site, but it's kept up to date with that version, for testing purposes.

FAQ distribution: `help/uk-tex-faq`

243 Reporting a L^AT_EX bug

The L^AT_EX team supports L^AT_EX, and will deal with *bona fide* bug reports. However, you need to be slightly careful to produce a bug report that is usable by the team. The steps are:

1. Are you still using current L^AT_EX? Maintenance is only available for sufficiently up-to-date versions of L^AT_EX — if your L^AT_EX is more than two versions out of date, the bug reporting mechanisms will reject your report.

2. Has your bug already been reported? Browse the L^AT_EX bugs database (see <http://www.latex-project.org/cgi-bin/ltxbugs2html?introduction=yes>), to find any earlier instance of your bug. In many cases, the database will list a work-around.

3. Prepare a "minimum" file that exhibits the problem. Ideally, such a file should contain no contributed packages — the L^AT_EX team as a whole takes no responsibility for such packages (if they're supported at all, they're supported by their authors). The "minimum" file should be self-sufficient: if a member of the team should run it in a clean directory, on a system with no contributed packages, it should replicate your problem.

4. Run your file through L^AT_EX: the bug system needs the `.log` file that this process creates.

You now have two possible ways to proceed: either create a mail report to send to the bug processing mechanism (5, below), or submit your bug report via the web (7, below).

5. Process the bug-report creation file, using L^AT_EX itself:

```
latex latexbug
```

`latexbug` asks you some questions, and then lets you describe the bug you've found. It produces an output file `latexbug.msg`, which includes the details you've supplied, your "minimum" example file, and the log file you got after running the example. (I always need to edit the result before submitting it: typing text into `latexbug` isn't much fun.)

6. Mail the resulting file to latex-bugs@latex-project.org; the subject line of your email should be the same as the bug title you gave to `latexbug`. The file `latexbug.msg` should be included into your message in-line: attachments are likely to be rejected by the bug processor.

7. Connect to the latex bugs processing web page (see <http://www.latex-project.org/bugs-upload.html>) and enter details of your bug — category, summary and full description, and the two important files (source and log file); note that the L^AT_EX team *need* your name and email address, as they may need to discuss the bug with you, or to advise you of a work-around.

244 What to do if you find a bug

For a start, make entirely sure you *have* found a bug. Double-check with books about T_EX, L^AT_EX, or whatever you're using; compare what you're seeing against the other answers above; ask every possible person you know who has any T_EX-related expertise. The reasons for all this caution are various.

If you've found a bug in T_EX itself, you're a rare animal indeed. Don Knuth is so sure of the quality of his code that he offers real money prizes to finders of bugs; the cheques he writes are such rare items that they are seldom cashed. If *you* think you have found a genuine fault in T_EX itself (or METAFONT, or the CM fonts, or the T_EXbook), don't immediately write to Knuth, however. He only looks at bugs once or twice a year, and even then only after they are agreed as bugs by a small vetting team. In the first instance, contact Barbara Beeton at the AMS (bnb@math.ams.org), or contact TUG (see question 21).

If you've found a bug in $\text{\LaTeX} 2_{\varepsilon}$, you may report it (see question 243) using mechanisms supplied in the \LaTeX distribution.

If you've found a bug in $\text{\LaTeX} 2.09$, or some other such unsupported software, there's not a lot you can do about it. You may find help or *de facto* support on a

newsgroup such as `comp.tex.tex` or on a mailing list such as `texhax@tex.ac.uk`, but posting non-bugs to any of these forums can lay you open to ridicule! Otherwise you need to go out and find yourself a willing \TeX -consultant — TUG maintains a register of \TeX consultants (see <http://www.tug.org/consultants.html>).