

# Standard Document Classes for L<sup>A</sup>T<sub>E</sub>X version 2e\*

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Copyright (C) 1994-2021 by Frank Mittelbach,  
Johannes Braams and the L<sup>A</sup>T<sub>E</sub>X Project Team

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## Contents

<b>1 The DOCSTRIP modules</b>	<b>3</b>
<b>2 Initial Code</b>	<b>3</b>
<b>3 Declaration of Options</b>	<b>4</b>
3.1 Setting Paper Sizes . . . . .	4
3.2 Choosing the type size . . . . .	4
3.3 Two-side or one-side printing . . . . .	5
3.4 Draft option . . . . .	5
3.5 Titlepage option . . . . .	5
3.6 openright option . . . . .	5
3.7 Two-column printing . . . . .	5
3.8 Equation numbering on the left . . . . .	5
3.9 Flush left displays . . . . .	6
3.10 Open bibliography . . . . .	6
<b>4 Executing Options</b>	<b>6</b>
<b>5 Loading Packages</b>	<b>7</b>
<b>6 Document Layout</b>	<b>7</b>
6.1 Fonts . . . . .	7
6.2 Paragraphing . . . . .	10
6.3 Page Layout . . . . .	11
6.3.1 Vertical spacing . . . . .	11
6.3.2 The dimension of text . . . . .	12
6.3.3 Margins . . . . .	14

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6.3.4	Footnotes	16
6.3.5	Float placement parameters	17
6.4	Page Styles	19
6.4.1	Marking conventions	20
6.4.2	Defining the page styles	20
<b>7</b>	<b>Document Markup</b>	<b>22</b>
7.1	The title	22
7.2	Chapters and Sections	25
7.2.1	Building blocks	25
7.2.2	Mark commands	26
7.2.3	Define Counters	26
7.2.4	Front Matter, Main Matter, and Back Matter	27
7.2.5	Parts	28
7.2.6	Chapters	31
7.2.7	Lower level headings	33
7.3	Lists	34
7.3.1	General List Parameters	34
7.3.2	Enumerate	36
7.3.3	Itemize	36
7.3.4	Description	37
7.4	Defining new environments	37
7.4.1	Abstract	37
7.4.2	Verse	38
7.4.3	Quotation	38
7.4.4	Quote	38
7.4.5	Theorem	39
7.4.6	Titlepage	39
7.4.7	Appendix	40
7.5	Setting parameters for existing environments	40
7.5.1	Array and tabular	40
7.5.2	Tabbing	41
7.5.3	Minipage	41
7.5.4	Framed boxes	41
7.5.5	Equation and eqnarray	41
7.6	Floating objects	42
7.6.1	Figure	42
7.6.2	Table	43
7.6.3	Captions	43
7.7	Font changing	44
<b>8</b>	<b>Cross Referencing</b>	<b>45</b>
8.1	Table of Contents, etc.	45
8.1.1	Table of Contents	46
8.1.2	List of figures	49
8.1.3	List of tables	49
8.2	Bibliography	50
8.3	The index	51
8.4	Footnotes	52

<b>9 Initialization</b>	<b>53</b>
9.1 Words	53
9.2 Date	53
9.3 Two-column mode	53
9.4 The page style	54
9.5 Single or double sided printing	54

## 1 The DOCSTRIP modules

The following modules are used in the implementation to direct DOCSTRIP in generating the external files:

article	produce the documentclass article
report	produce the documentclass report
size10	produce the class option for 10pt
size11	produce the class option for 11pt
size12	produce the class option for 12pt
book	produce the documentclass book
bk10	produce the book class option for 10pt
bk11	produce the book class option for 11pt
bk12	produce the book class option for 12pt
driver	produce a documentation driver file

## 2 Initial Code

In this part we define a few commands that are used later on.

`\@ptsize` This control sequence is used to store the second digit of the pointsize we are typesetting in. So, normally, its value is one of 0, 1 or 2.

```
1 \*article | report | book)
2 \newcommand\@ptsize{}
```

`\if@restonecol` When the document has to be printed in two columns, we sometimes have to temporarily switch to one column. This switch is used to remember to switch back.

```
3 \newif\if@restonecol
```

`\if@titlepage` A switch to indicate if a titlepage has to be produced. For the article document class the default is not to make a separate titlepage.

```
4 \newif\if@titlepage
5 \article)\@titlepagefalse
6 \!article)\@titlepagetrue
```

`\if@openright` A switch to indicate if chapters must start on a right-hand page. The default for the report class is no; for the book class it's yes.

```
7 \!article)\newif\if@openright
```

`\if@mainmatter` The switch `\if@mainmatter`, only available in the document class book, indicates whether we are processing the main material in the book.

```
8 \book)\newif\if@mainmatter \@mainmattertrue
```

## 3 Declaration of Options

### 3.1 Setting Paper Sizes

The variables `\paperwidth` and `\paperheight` should reflect the physical paper size after trimming. For desk printer output this is usually the real paper size since there is no post-processing. Classes for real book production will probably add other paper sizes and additionally the production of crop marks for trimming. In compatibility mode, these (and some of the subsequent) options are disabled, as they were not present in L<sup>A</sup>T<sub>E</sub>X2.09.

```
9 \if@compatibility\else
10 \DeclareOption{a4paper}
11   {\setlength\paperheight {297mm}%
12    \setlength\paperwidth  {210mm}}
13 \DeclareOption{a5paper}
14   {\setlength\paperheight {210mm}%
15    \setlength\paperwidth  {148mm}}
16 \DeclareOption{b5paper}
17   {\setlength\paperheight {250mm}%
18    \setlength\paperwidth  {176mm}}
19 \DeclareOption{letterpaper}
20   {\setlength\paperheight {11in}%
21    \setlength\paperwidth  {8.5in}}
22 \DeclareOption{legalpaper}
23   {\setlength\paperheight {14in}%
24    \setlength\paperwidth  {8.5in}}
25 \DeclareOption{executivepaper}
26   {\setlength\paperheight {10.5in}%
27    \setlength\paperwidth  {7.25in}}
```

The option `landscape` switches the values of `\paperheight` and `\paperwidth`, assuming the dimensions were given for portrait paper.

```
28 \DeclareOption{landscape}
29   {\setlength\@tempdima  {\paperheight}%
30    \setlength\paperheight {\paperwidth}%
31    \setlength\paperwidth  {\@tempdima}}
32 \fi
```

### 3.2 Choosing the type size

The type size options are handled by defining `\@ptsize` to contain the last digit of the size in question and branching on `\ifcase` statements. This is done for historical reasons to stay compatible with other packages that use the `\@ptsize` variable to select special actions. It makes the declarations of size options less than 10pt difficult, although one can probably use 9 and 8 assuming that a class won't define both 8pt and 18pt options.

```
33 \if@compatibility
34   \renewcommand\@ptsize{0}
35 \else
36   \DeclareOption{10pt}{\renewcommand\@ptsize{0}}
37 \fi
38 \DeclareOption{11pt}{\renewcommand\@ptsize{1}}
39 \DeclareOption{12pt}{\renewcommand\@ptsize{2}}
```

### 3.3 Two-side or one-side printing

For two-sided printing we use the switch `\if@twoside`. In addition we have to set the `\if@mparswitch` to get any margin paragraphs into the outside margin.

```
40 \if@compatibility\else
41   \DeclareOption{oneside}{\@twosidefalse \@mparswitchfalse}
42 \fi
43 \DeclareOption{twoside}{\@twosidetrue \@mparswitchtrue}
```

### 3.4 Draft option

If the user requests draft we show any overfull boxes. We could probably add some more interesting stuff to this option.

```
44 \DeclareOption{draft}{\setlength\overfullrule{5pt}}
45 \if@compatibility\else
46   \DeclareOption{final}{\setlength\overfullrule{0pt}}
47 \fi
```

### 3.5 Titlepage option

An article usually has no separate titlepage, but the user can request one.

```
48 \DeclareOption{titlepage}{\@titlepagetrue}
49 \if@compatibility\else
50   \DeclareOption{notitlepage}{\@titlepagefalse}
51 \fi
```

### 3.6 openright option

This option determines whether or not a chapter must start on a right-hand page request one.

```
52 \!article\if@compatibility
53 \book\@openrighttrue
54 \!article\else
55 \!article\DeclareOption{openright}{\@openrighttrue}
56 \!article\DeclareOption{openany}{\@openrightfalse}
57 \!article\fi
```

### 3.7 Two-column printing

Two-column and one-column printing is again realized via a switch.

```
58 \if@compatibility\else
59   \DeclareOption{onecolumn}{\@twocolumnfalse}
60 \fi
61 \DeclareOption{twocolumn}{\@twocolumntrue}
```

### 3.8 Equation numbering on the left

The option `leqno` can be used to get the equation numbers on the left side of the equation. It loads code which is generated automatically from the kernel files when the format is built. If the equation number does get a special formatting

then instead of using the kernel file the class would need to provide the code explicitly.

```
62 \DeclareOption{leqno}{\input{leqno.clo}}
```

### 3.9 Flush left displays

The option `fleqn` redefines the displayed math environments in such a way that they come out flush left, with an indentation of `\mathindent` from the prevailing left margin. It loads code which is generated automatically from the kernel files when the format is built.

```
63 \DeclareOption{fleqn}{\input{fleqn.clo}}
```

### 3.10 Open bibliography

The option `openbib` produces the “open” bibliography style, in which each block starts on a new line, and succeeding lines in a block are indented by `\bibindent`.

```
64 \DeclareOption{openbib}{%
```

First some hook into the bibliography environment is filled.

```
65 \AtEndOfPackage{%
66   \renewcommand\@openbib@code{%
67     \advance\leftmargin\bibindent
68     \itemindent -\bibindent
69     \listparindent \itemindent
70     \parsep \z@
71   }%
```

In addition the definition of `\newblock` is overwritten.

```
72   \renewcommand\newblock{\par}}%
73 }
```

## 4 Executing Options

Here we execute the default options to initialize certain variables. Note that the document class ‘book’ always uses two sided printing.

```
74 <*article>
75 \ExecuteOptions{letterpaper,10pt,oneside,onecolumn,final}
76 </article>
77 <*report>
78 \ExecuteOptions{letterpaper,10pt,oneside,onecolumn,final,openany}
79 </report>
80 <*book>
81 \ExecuteOptions{letterpaper,10pt,twoside,onecolumn,final,openright}
82 </book>
```

The `\ProcessOptions` command causes the execution of the code for every option `FOO` which is declared and for which the user typed the `FOO` option in his `\documentclass` command. For every option `BAR` he typed, which is not declared, the option is assumed to be a global option. All options will be passed as document options to any `\usepackage` command in the document preamble.

```
83 \ProcessOptions
```

Now that all the options have been executed we can load the chosen class option file that contains all size dependent code.

```
84 <!book>\input{size1\@ptsize.clo}
85 <book>\input{bk1\@ptsize.clo}
86 </article | report | book>
```

## 5 Loading Packages

The standard class files do not load additional packages.

## 6 Document Layout

In this section we are finally dealing with the nasty typographical details.

### 6.1 Fonts

L<sup>A</sup>T<sub>E</sub>X offers the user commands to change the size of the font, relative to the ‘main’ size. Each relative size changing command `\size` executes the command `\setfontsize\size<font-size><baselineskip>` where:

`<font-size>` The absolute size of the font to use from now on.

`<baselineskip>` The normal value of `\baselineskip` for the size of the font selected. (The actual value will be `\baselinestretch * <baselineskip>`.)

A number of commands, defined in the L<sup>A</sup>T<sub>E</sub>X kernel, shorten the following definitions and are used throughout. They are:

<code>\vpt</code>	5	<code>\vipt</code>	6	<code>\viipt</code>	7
<code>\viipt</code>	8	<code>\ixpt</code>	9	<code>\xpt</code>	10
<code>\xipt</code>	10.95	<code>\xiipt</code>	12	<code>\xivpt</code>	14.4
...					

`\normalsize` The user level command for the main size is `\normalsize`. Internally L<sup>A</sup>T<sub>E</sub>X uses `\@normalsize` when it refers to the main size. `\@normalsize` will be defined to work like `\normalsize` if the latter is redefined from its default definition (that just issues an error message). Otherwise `\@normalsize` simply selects a 10pt/12pt size.

The `\normalsize` macro also sets new values for `\abovedisplayskip`, `\abovedisplayshortskip` and `\belowdisplayshortskip`.

```
87 <*10pt | 11pt | 12pt>
88 \renewcommand\normalsize{%
89 <*10pt>
90   \setfontsize\normalsize\@xpt\@xiipt
91   \abovedisplayskip 10\p@ \@plus2\p@ \@minus5\p@
92   \abovedisplayshortskip \z@ \@plus3\p@
93   \belowdisplayshortskip 6\p@ \@plus3\p@ \@minus3\p@
94 </10pt>
95 <*11pt>
96   \setfontsize\normalsize\@xipt{13.6}%
97   \abovedisplayskip 11\p@ \@plus3\p@ \@minus6\p@
```

```

98   \abovedisplayshortskip \z@ \@plus3\p@
99   \belowdisplayshortskip 6.5\p@ \@plus3.5\p@ \@minus3\p@
100 </11pt>
101 <*12pt>
102   \@setfontsize\normalsize\@xiipt{14.5}%
103   \abovedisplayskip 12\p@ \@plus3\p@ \@minus7\p@
104   \abovedisplayshortskip \z@ \@plus3\p@
105   \belowdisplayshortskip 6.5\p@ \@plus3.5\p@ \@minus3\p@
106 </12pt>

```

The `\belowdisplayskip` is always equal to the `\abovedisplayskip`. The parameters of the first level list are always given by `\@listI`.

```

107   \belowdisplayskip \abovedisplayskip
108   \let\@listi\@listI}

```

We initially choose the `normalsize` font.

```

109 \normalsize

```

We use `\MakeRobust` instead of `\DeclareRobustCommand` above to avoid a log entry for the redefinition. But if we are running in a rollback situation (prior to 2015) we don't touch it.

```

110 \ifx\MakeRobust\@undefined \else
111   \MakeRobust\normalsize
112 \fi

```

`\small` This is similar to `\normalsize`.

```

113 \DeclareRobustCommand\small{%
114 <*10pt>
115   \@setfontsize\small\@ixpt{11}%
116   \abovedisplayskip 8.5\p@ \@plus3\p@ \@minus4\p@
117   \abovedisplayshortskip \z@ \@plus2\p@
118   \belowdisplayshortskip 4\p@ \@plus2\p@ \@minus2\p@
119   \def\@listi{\leftmargin\leftmargini
120             \topsep 4\p@ \@plus2\p@ \@minus2\p@
121             \parsep 2\p@ \@plus\p@ \@minus\p@
122             \itemsep \parsep}%
123 </10pt>
124 <*11pt>
125   \@setfontsize\small\@xpt\@xiipt
126   \abovedisplayskip 10\p@ \@plus2\p@ \@minus5\p@
127   \abovedisplayshortskip \z@ \@plus3\p@
128   \belowdisplayshortskip 6\p@ \@plus3\p@ \@minus3\p@
129   \def\@listi{\leftmargin\leftmargini
130             \topsep 6\p@ \@plus2\p@ \@minus2\p@
131             \parsep 3\p@ \@plus2\p@ \@minus\p@
132             \itemsep \parsep}%
133 </11pt>
134 <*12pt>
135   \@setfontsize\small\@xipt{13.6}%
136   \abovedisplayskip 11\p@ \@plus3\p@ \@minus6\p@
137   \abovedisplayshortskip \z@ \@plus3\p@
138   \belowdisplayshortskip 6.5\p@ \@plus3.5\p@ \@minus3\p@
139   \def\@listi{\leftmargin\leftmargini
140             \topsep 9\p@ \@plus3\p@ \@minus5\p@
141             \parsep 4.5\p@ \@plus2\p@ \@minus\p@

```

```

142             \itemsep \parsep}%
143 </12pt>
144     \belowdisplayskip \abovedisplayskip
145 }

```

`\footnotesize` This is similar to `\normalsize`.

```

146 \DeclareRobustCommand\footnotesize{%
147 <*10pt>
148     \@setfontsize\footnotesize\@viipt{9.5}%
149     \abovedisplayskip 6\p@ \@plus2\p@ \@minus4\p@
150     \abovedisplayshortskip \z@ \@plus\p@
151     \belowdisplayshortskip 3\p@ \@plus\p@ \@minus2\p@
152     \def\@listif\leftmargin\leftmargini
153         \topsep 3\p@ \@plus\p@ \@minus\p@
154         \parsep 2\p@ \@plus\p@ \@minus\p@
155         \itemsep \parsep}%
156 </10pt>
157 <*11pt>
158     \@setfontsize\footnotesize\@ixpt{11}%
159     \abovedisplayskip 8\p@ \@plus2\p@ \@minus4\p@
160     \abovedisplayshortskip \z@ \@plus\p@
161     \belowdisplayshortskip 4\p@ \@plus2\p@ \@minus2\p@
162     \def\@listif\leftmargin\leftmargini
163         \topsep 4\p@ \@plus2\p@ \@minus2\p@
164         \parsep 2\p@ \@plus\p@ \@minus\p@
165         \itemsep \parsep}%
166 </11pt>
167 <*12pt>
168     \@setfontsize\footnotesize\@xpt\@xipt
169     \abovedisplayskip 10\p@ \@plus2\p@ \@minus5\p@
170     \abovedisplayshortskip \z@ \@plus3\p@
171     \belowdisplayshortskip 6\p@ \@plus3\p@ \@minus3\p@
172     \def\@listif\leftmargin\leftmargini
173         \topsep 6\p@ \@plus2\p@ \@minus2\p@
174         \parsep 3\p@ \@plus2\p@ \@minus\p@
175         \itemsep \parsep}%
176 </12pt>
177     \belowdisplayskip \abovedisplayskip
178 }
179 </10pt | 11pt | 12pt>

```

`\scriptsize` These are all much simpler than the previous macros, they just select a new fontsize, but leave the parameters for displays and lists alone.

```

\large 180 <*10pt>
\Large 181 \DeclareRobustCommand\scriptsize{\@setfontsize\scriptsize\@viipt\@viiipt}
\LARGE 182 \DeclareRobustCommand\tiny{\@setfontsize\tiny\@vpt\@vipt}
\huge 183 \DeclareRobustCommand\large{\@setfontsize\large\@xipt{14}}
\Huge 184 \DeclareRobustCommand\Large{\@setfontsize\Large\@xivpt{18}}
185 \DeclareRobustCommand\LARGE{\@setfontsize\LARGE\@xxviipt{22}}
186 \DeclareRobustCommand\huge{\@setfontsize\huge\@xxpt{25}}
187 \DeclareRobustCommand\Huge{\@setfontsize\Huge\@xxvpt{30}}
188 </10pt>
189 <*11pt>
190 \DeclareRobustCommand\scriptsize{\@setfontsize\scriptsize\@viiipt{9.5}}

```

```

191 \DeclareRobustCommand\tiny{\@setfontsize\tiny\@vipt\@viipt}
192 \DeclareRobustCommand\large{\@setfontsize\large\@xiipt{14}}
193 \DeclareRobustCommand\Large{\@setfontsize\Large\@xivpt{18}}
194 \DeclareRobustCommand\LARGE{\@setfontsize\LARGE\@xxviipt{22}}
195 \DeclareRobustCommand\huge{\@setfontsize\huge\@xxpt{25}}
196 \DeclareRobustCommand\Huge{\@setfontsize\Huge\@xxvpt{30}}
197 </11pt>
198 <*12pt>
199 \DeclareRobustCommand\scriptsize{\@setfontsize\scriptsize\@viiipt{9.5}}
200 \DeclareRobustCommand\tiny{\@setfontsize\tiny\@vipt\@viipt}
201 \DeclareRobustCommand\large{\@setfontsize\large\@xivpt{18}}
202 \DeclareRobustCommand\Large{\@setfontsize\Large\@xxviipt{22}}
203 \DeclareRobustCommand\LARGE{\@setfontsize\LARGE\@xxpt{25}}
204 \DeclareRobustCommand\huge{\@setfontsize\huge\@xxvpt{30}}
205 \let\Huge=\huge
206 </12pt>

```

## 6.2 Paragraphing

`\lineskip` These parameters control  $\TeX$ 's behaviour when two lines tend to come too close together.

```

207 <*article | report | book>
208 \setlength\lineskip{1\p@}
209 \setlength\normallineskip{1\p@}

```

`\baselinestretch` This is used as a multiplier for `\baselineskip`. The default is to *not* stretch the baselines. Note that if this command doesn't resolve to "empty" any plus or minus part in the specification of `\baselineskip` is ignored.

```

210 \renewcommand\baselinestretch{}

```

`\parskip` `\parskip` gives extra vertical space between paragraphs and `\parindent` is the width of the paragraph indentation. The value of `\parindent` depends on whether we are in two-column mode.

```

211 \setlength\parskip{0\p@ \@plus \p@}
212 </article | report | book>
213 <*10pt | 11pt | 12pt>
214 \if@twocolumn
215   \setlength\parindent{1em}
216 \else
217 <10pt>   \setlength\parindent{15\p@}
218 <11pt>   \setlength\parindent{17\p@}
219 <12pt>   \setlength\parindent{1.5em}
220 \fi
221 </10pt | 11pt | 12pt>

```

`\smallskipamount` The values for these three parameters are set in the  $\LaTeX$  kernel. They should perhaps vary, according to the size option specified. But as they have always had the same value regardless of the size option we do not change them to stay compatible with both  $\LaTeX$  2.09 and older releases of  $\LaTeX$  2 $\epsilon$ .

```

222 <*10pt | 11pt | 12pt>
223 \setlength\smallskipamount{3\p@ \@plus 1\p@ \@minus 1\p@}
224 \setlength\medskipamount{6\p@ \@plus 2\p@ \@minus 2\p@}
225 \setlength\bigskipamount{12\p@ \@plus 4\p@ \@minus 4\p@}

```

226  $\langle /10pt | 11pt | 12pt \rangle$

`\@lowpenalty` The commands `\nopagebreak` and `\nolinebreak` put in penalties to discourage  
`\@medpenalty` these breaks at the point they are put in. They use `\@lowpenalty`, `\@medpenalty`  
`\@highpenalty` or `\@highpenalty`, dependent on their argument.

227  $\langle *article | report | book \rangle$

228 `\@lowpenalty 51`

229 `\@medpenalty 151`

230 `\@highpenalty 301`

`\clubpenalty` These penalties are use to discourage club and widow lines. Because we use their  
`\widowpenalty` default values we only show them here, commented out.

231 `% \clubpenalty 150`

232 `% \widowpenalty 150`

`\displaywidowpenalty` Discourage (but not so much) widows in front of a math display and forbid break-  
`\predisplaypenalty` ing directly in front of a display. Allow break after a display without a penalty.

`\postdisplaypenalty` Again the default values are used, therefore we only show them here.

233 `% \displaywidowpenalty 50`

234 `% \predisplaypenalty 10000`

235 `% \postdisplaypenalty 0`

`\interlinepenalty` Allow the breaking of a page in the middle of a paragraph.

236 `% \interlinepenalty 0`

`\brokenpenalty` We allow the breaking of a page after a hyphenated line.

237 `% \brokenpenalty 100`

238  $\langle /article | report | book \rangle$

## 6.3 Page Layout

All margin dimensions are measured from a point one inch from the top and lefthand side of the page.

### 6.3.1 Vertical spacing

`\headheight` The `\headheight` is the height of the box that will contain the running head. The

`\headsep` `\headsep` is the distance between the bottom of the running head and the top of

`\topskip` the text. The `\topskip` is the `\baselineskip` for the first line on a page; L<sup>A</sup>T<sub>E</sub>X's output routine will not work properly if it has the value 0pt, so do not do that!

239  $\langle *10pt | 11pt | 12pt \rangle$

240 `\setlength\headheight{12\p@}`

241  $\langle !bk \rangle \setlength\headsep {25\p@}$

242  $\langle 10pt \ \& \ bk \rangle \setlength\headsep {.25in}$

243  $\langle 11pt \ \& \ bk \rangle \setlength\headsep {.275in}$

244  $\langle 12pt \ \& \ bk \rangle \setlength\headsep {.275in}$

245  $\langle 10pt \rangle \setlength\topskip {10\p@}$

246  $\langle 11pt \rangle \setlength\topskip {11\p@}$

247  $\langle 12pt \rangle \setlength\topskip {12\p@}$

`\footskip` The distance from the baseline of the box which contains the running footer to the baseline of last line of text is controlled by the `\footskip`.

```
248 <!bk>\setlength\footskip{30\p@}
249 <10pt & bk>\setlength\footskip{.35in}
250 <11pt & bk>\setlength\footskip{.38in}
251 <12pt & bk>\setlength\footskip{30\p@}
```

`\maxdepth` The  $\TeX$  primitive register `\maxdepth` has a function that is similar to that of `\topskip`. The register `\@maxdepth` should always contain a copy of `\maxdepth`. This is achieved by setting it internally at `\begin{document}`. In both plain  $\TeX$  and  $\LaTeX$  2.09 `\maxdepth` had a fixed value of `4pt`; in native  $\LaTeX$ 2e mode we let the value depend on the typesize. We set it so that `\maxdepth + \topskip = typesize  $\times$  1.5`. As it happens, in these classes `\topskip` is equal to the typesize, therefore we set `\maxdepth` to half the value of `\topskip`.

```
252 \if@compatibility \setlength\maxdepth{4\p@} \else
253 \setlength\maxdepth{.5\topskip} \fi
```

### 6.3.2 The dimension of text

`\textwidth` When we are in compatibility mode we have to make sure that the dimensions of the printed area are not different from what the user was used to see.

```
254 \if@compatibility
255 \if@twocolumn
256 \setlength\textwidth{410\p@}
257 \else
258 <10pt&!bk> \setlength\textwidth{345\p@}
259 <11pt&!bk> \setlength\textwidth{360\p@}
260 <12pt&!bk> \setlength\textwidth{390\p@}
261 <10pt & bk> \setlength\textwidth{4.5in}
262 <11pt & bk> \setlength\textwidth{5in}
263 <12pt & bk> \setlength\textwidth{5in}
264 \fi
```

When we are not in compatibility mode we can set some of the dimensions differently, taking into account the paper size for instance.

```
265 \else
```

First, we calculate the maximum `\textwidth`, which we will allow on the selected paper and store it in `\@tempdima`. Then we store the length of a line with approximately 60–70 characters in `\@tempdimb`. The values given are more or less suitable when Computer Modern fonts are used.

```
266 \setlength\@tempdima{\paperwidth}
267 \addtolength\@tempdima{-2in}
268 <10pt> \setlength\@tempdimb{345\p@}
269 <11pt> \setlength\@tempdimb{360\p@}
270 <12pt> \setlength\@tempdimb{390\p@}
```

Now we can set the `\textwidth`, depending on whether we will be setting one or two columns.

In two-column mode each *column* shouldn't be wider than `\@tempdimb` (which could happen on A3 paper for instance).

```
271 \if@twocolumn
272 \ifdim\@tempdima>2\@tempdimb\relax
```

```

273     \setlength\textwidth{2\@tempdimb}
274     \else
275     \setlength\textwidth{\@tempdima}
276     \fi

```

In one-column mode the text should not be wider than the minimum of the paperwidth (minus 2 inches for the margins) and the maximum length of a line as defined by the number of characters.

```

277 \else
278   \ifdim\@tempdima>\@tempdimb\relax
279   \setlength\textwidth{\@tempdimb}
280   \else
281   \setlength\textwidth{\@tempdima}
282   \fi
283 \fi
284 \fi

```

Here we modify the width of the text a little to be a whole number of points.

```

285 \if@compatibility\else
286 \settopoint\textwidth
287 \fi

```

`\textheight` Now that we have computed the width of the text, we have to take care of the height. The `\textheight` is the height of text (including footnotes and figures, excluding running head and foot).

First make sure that the compatibility mode gets the same dimensions as we had with L<sup>A</sup>T<sub>E</sub>X2.09. The number of lines was calculated as the floor of the old `\textheight` minus `\topskip`, divided by `\baselineskip` for `\normalsize`. The old value of `\textheight` was 528pt.

```

288 \if@compatibility
289 <10pt&!bk> \setlength\textheight{43\baselineskip}
290 <10pt & bk> \setlength\textheight{41\baselineskip}
291 <11pt> \setlength\textheight{38\baselineskip}
292 <12pt> \setlength\textheight{36\baselineskip}

```

Again we compute this, depending on the papersize and depending on the `\baselineskip` that is used, in order to have a whole number of lines on the page.

```

293 \else
294 \setlength\@tempdima{\paperheight}

```

We leave at least a 1 inch margin on the top and the bottom of the page.

```

295 \addtolength\@tempdima{-2in}

```

We also have to leave room for the running headers and footers.

```

296 \addtolength\@tempdima{-1.5in}

```

Then we divide the result by the current `\baselineskip` and store this in the count register `\@tempcnta`, which then contains the number of lines that fit on this page.

```

297 \divide\@tempdima\baselineskip
298 \@tempcnta=\@tempdima

```

From this we can calculate the height of the text.

```

299 \setlength\textheight{\@tempcnta\baselineskip}
300 \fi

```

The first line on the page has a height of `\topskip`.

```
301 \addtolength\textheight{\topskip}
```

### 6.3.3 Margins

Most of the values of these parameters are now calculated, based on the papersize in use. In the calculations the `\marginparsep` needs to be taken into account so we give it its value first.

`\marginparsep` The horizontal space between the main text and marginal notes is determined by `\marginparsep`, the minimum vertical separation between two marginal notes is controlled by `\marginparpush`.

```
302 \if@twocolumn
303   \setlength\marginparsep {10\p@}
304 \else
305 <10pt&!bk>   \setlength\marginparsep{11\p@}
306 <11pt&!bk>   \setlength\marginparsep{10\p@}
307 <12pt&!bk>   \setlength\marginparsep{10\p@}
308 <bk>         \setlength\marginparsep{7\p@}
309 \fi
310 <10pt | 11pt> \setlength\marginparpush{5\p@}
311 <12pt> \setlength\marginparpush{7\p@}
```

Now we can give the values for the other margin parameters. For native L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>, these are calculated.

`\oddsidemargin` First we give the values for the compatibility mode.

`\evensidemargin` Values for two-sided printing:

```
\marginparwidth 312 \if@compatibility
313 <*bk>
314 <10pt>   \setlength\oddsidemargin  {.5in}
315 <11pt>   \setlength\oddsidemargin  {.25in}
316 <12pt>   \setlength\oddsidemargin  {.25in}
317 <10pt>   \setlength\evensidemargin {1.5in}
318 <11pt>   \setlength\evensidemargin {1.25in}
319 <12pt>   \setlength\evensidemargin {1.25in}
320 <10pt>   \setlength\marginparwidth {.75in}
321 <11pt>   \setlength\marginparwidth {1in}
322 <12pt>   \setlength\marginparwidth {1in}
323 </bk>
324 <!*bk>
325   \if@twoside
326 <10pt>   \setlength\oddsidemargin  {44\p@}
327 <11pt>   \setlength\oddsidemargin  {36\p@}
328 <12pt>   \setlength\oddsidemargin  {21\p@}
329 <10pt>   \setlength\evensidemargin {82\p@}
330 <11pt>   \setlength\evensidemargin {74\p@}
331 <12pt>   \setlength\evensidemargin {59\p@}
332 <10pt>   \setlength\marginparwidth {107\p@}
333 <11pt>   \setlength\marginparwidth {100\p@}
334 <12pt>   \setlength\marginparwidth {85\p@}
```

Values for one-sided printing:

```
335   \else
```

```

336 <10pt> \setlength\oddsidemargin {63\p@}
337 <11pt> \setlength\oddsidemargin {54\p@}
338 <12pt> \setlength\oddsidemargin {39.5\p@}
339 <10pt> \setlength\evensidemargin {63\p@}
340 <11pt> \setlength\evensidemargin {54\p@}
341 <12pt> \setlength\evensidemargin {39.5\p@}
342 <10pt> \setlength\marginparwidth {90\p@}
343 <11pt> \setlength\marginparwidth {83\p@}
344 <12pt> \setlength\marginparwidth {68\p@}
345 \fi
346 </!bk>

```

And values for two-column mode:

```

347 \if@twocolumn
348 \setlength\oddsidemargin {30\p@}
349 \setlength\evensidemargin {30\p@}
350 \setlength\marginparwidth {48\p@}
351 \fi

```

When we are not in compatibility mode we can take the dimensions of the selected paper into account.

The values for `\oddsidemargin` and `\marginparwidth` will be set depending on the status of the `\if@twoside`.

If `@twoside` is true (which is always the case for book) we make the inner margin smaller than the outer one.

```

352 \else
353 \if@twoside
354 \setlength\@tempdima {\paperwidth}
355 \addtolength\@tempdima {-\textwidth}
356 \setlength\oddsidemargin {.4\@tempdima}
357 \addtolength\oddsidemargin {-1in}

```

The width of the margin for text is set to the remainder of the width except for a ‘real margin’ of white space of width 0.4in. A check should perhaps be built in to ensure that the (text) margin width does not get too small!

```

358 \setlength\marginparwidth {.6\@tempdima}
359 \addtolength\marginparwidth {-\marginparsep}
360 \addtolength\marginparwidth {-0.4in}

```

For one-sided printing we center the text on the page, by calculating the difference between `\textwidth` and `\paperwidth`. Half of that difference is than used for the margin (thus `\oddsidemargin` is 1in less).

```

361 \else
362 \setlength\@tempdima {\paperwidth}
363 \addtolength\@tempdima {-\textwidth}
364 \setlength\oddsidemargin {.5\@tempdima}
365 \addtolength\oddsidemargin {-1in}
366 \setlength\marginparwidth {.5\@tempdima}
367 \addtolength\marginparwidth {-\marginparsep}
368 \addtolength\marginparwidth {-0.4in}
369 \addtolength\marginparwidth {-0.4in}
370 \fi

```

With the above algorithm the `\marginparwidth` can come out quite large which we may not want.

```

371 \ifdim \marginparwidth >2in
372     \setlength\marginparwidth{2in}
373 \fi

```

Having done these calculations we make them pt values.

```

374 \@settopoint\oddsidemargin
375 \@settopoint\marginparwidth

```

The `\evensidemargin` can now be computed from the values set above.

```

376 \setlength\evensidemargin {\paperwidth}
377 \addtolength\evensidemargin{-2in}
378 \addtolength\evensidemargin{-\textwidth}
379 \addtolength\evensidemargin{-\oddsidemargin}

```

Setting `\evensidemargin` to a full point value may produce a small error. However it will lie within the error range a doublesided printer of today's technology can accurately print.

```

380 \@settopoint\evensidemargin
381 \fi

```

`\topmargin` The `\topmargin` is the distance between the top of 'the printable area'—which is 1 inch below the top of the paper—and the top of the box which contains the running head.

It can now be computed from the values set above.

```

382 \if@compatibility
383 <!bk> \setlength\topmargin{27pt}
384 <10pt & bk> \setlength\topmargin{.75in}
385 <11pt & bk> \setlength\topmargin{.73in}
386 <12pt & bk> \setlength\topmargin{.73in}
387 \else
388 \setlength\topmargin{\paperheight}
389 \addtolength\topmargin{-2in}
390 \addtolength\topmargin{-\headheight}
391 \addtolength\topmargin{-\headsep}
392 \addtolength\topmargin{-\textheight}
393 \addtolength\topmargin{-\footskip} % this might be wrong!

```

By changing the factor in the next line the complete page can be shifted vertically.

```

394 \addtolength\topmargin{-.5\topmargin}
395 \@settopoint\topmargin
396 \fi

```

### 6.3.4 Footnotes

`\footnotesep` `\footnotesep` is the height of the strut placed at the beginning of every footnote. It equals the height of a normal `\footnotesize` strut in this class, thus no extra space occurs between footnotes.

```

397 <10pt> \setlength\footnotesep{6.65\p@}
398 <11pt> \setlength\footnotesep{7.7\p@}
399 <12pt> \setlength\footnotesep{8.4\p@}

```

`\footins` `\skip\footins` is the space between the last line of the main text and the top of the first footnote.

```

400 <10pt> \setlength{\skip\footins}{9\p@ \@plus 4\p@ \@minus 2\p@}

```

```

401 <11pt>\setlength{\skip\footins}{10\p@ \@plus 4\p@ \@minus 2\p@}
402 <12pt>\setlength{\skip\footins}{10.8\p@ \@plus 4\p@ \@minus 2\p@}
403 </10pt | 11pt | 12pt>

```

### 6.3.5 Float placement parameters

All float parameters are given default values in the L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> kernel. For this reason parameters that are not counters need to be set with `\renewcommand`.

#### Limits for the placement of floating objects

- `\c@topnumber` The *topnumber* counter holds the maximum number of floats that can appear on the top of a text page.
- ```

404 <*article | report | book>
405 \setcounter{topnumber}{2}

```
- `\topfraction` This indicates the maximum part of a text page that can be occupied by floats at the top.
- ```

406 \renewcommand\topfraction{.7}

```
- `\c@bottomnumber` The *bottomnumber* counter holds the maximum number of floats that can appear on the bottom of a text page.
- ```

407 \setcounter{bottomnumber}{1}

```
- `\bottomfraction` This indicates the maximum part of a text page that can be occupied by floats at the bottom.
- ```

408 \renewcommand\bottomfraction{.3}

```
- `\c@totalnumber` This indicates the maximum number of floats that can appear on any text page.
- ```

409 \setcounter{totalnumber}{3}

```
- `\textfraction` This indicates the minimum part of a text page that has to be occupied by text.
- ```

410 \renewcommand\textfraction{.2}

```
- `\floatpagefraction` This indicates the minimum part of a page that has to be occupied by floating objects before a ‘float page’ is produced.
- ```

411 \renewcommand\floatpagefraction{.5}

```
- `\c@dbltopnumber` The *dbltopnumber* counter holds the maximum number of two-column floats that can appear on the top of a two-column text page.
- ```

412 \setcounter{dbltopnumber}{2}

```
- `\dbltopfraction` This indicates the maximum part of a two-column text page that can be occupied by two-column floats at the top.
- ```

413 \renewcommand\dbltopfraction{.7}

```
- `\dblfloatpagefraction` This indicates the minimum part of a page that has to be occupied by two-column wide floating objects before a ‘float page’ is produced.
- ```

414 \renewcommand\dblfloatpagefraction{.5}
415 </article | report | book>

```

## Floats on a text page

`\floatsep` When a floating object is placed on a page with text, these parameters control the separation between the float and the other objects on the page. These parameters  
`\textfloatsep`  
`\intextsep` are used for both one-column mode and single-column floats in two-column mode.

`\floatsep` is the space between adjacent floats that are moved to the top or bottom of the text page.

`\textfloatsep` is the space between the main text and floats at the top or bottom of the page.

`\intextsep` is the space between in-text floats and the text.

```
416 <*10pt>
417 \setlength\floatsep    {12\p@ \@plus 2\p@ \@minus 2\p@}
418 \setlength\textfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
419 \setlength\intextsep   {12\p@ \@plus 2\p@ \@minus 2\p@}
420 </10pt>
421 <*11pt>
422 \setlength\floatsep    {12\p@ \@plus 2\p@ \@minus 2\p@}
423 \setlength\textfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
424 \setlength\intextsep   {12\p@ \@plus 2\p@ \@minus 2\p@}
425 </11pt>
426 <*12pt>
427 \setlength\floatsep    {12\p@ \@plus 2\p@ \@minus 4\p@}
428 \setlength\textfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
429 \setlength\intextsep   {14\p@ \@plus 4\p@ \@minus 4\p@}
430 </12pt>
```

`\dblfloatsep` When floating objects that span the whole `\textwidth` are placed on a text page  
`\dbltextfloatsep` when we are in two-column mode the separation between the float and the text is controlled by `\dblfloatsep` and `\dbltextfloatsep`.

`\dblfloatsep` is the space between adjacent floats that are moved to the top or bottom of the text page.

`\dbltextfloatsep` is the space between the main text and floats at the top or bottom of the page.

```
431 <*10pt>
432 \setlength\dblfloatsep  {12\p@ \@plus 2\p@ \@minus 2\p@}
433 \setlength\dbltextfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
434 </10pt>
435 <*11pt>
436 \setlength\dblfloatsep  {12\p@ \@plus 2\p@ \@minus 2\p@}
437 \setlength\dbltextfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
438 </11pt>
439 <*12pt>
440 \setlength\dblfloatsep  {14\p@ \@plus 2\p@ \@minus 4\p@}
441 \setlength\dbltextfloatsep{20\p@ \@plus 2\p@ \@minus 4\p@}
442 </12pt>
```

## Floats on their own page or column

`\@fptop` When floating objects are placed on separate pages the layout of such pages is controlled by these parameters. At the top of the page `\@fptop` amount of stretchable  
`\@fpsep` whitespace is inserted, at the bottom of the page we get an `\@fpbot` amount of  
`\@fpbot` stretchable whitespace. Between adjacent floats the `\@fpsep` is inserted.

These parameters are used for the placement of floating objects in one-column mode, or in single-column floats in two-column mode.

Note that at least one of the two parameters `\@fptop` and `\@fpbot` should contain a `plus ...fil` to allow filling the remaining empty space.

```

443 <*10pt>
444 \setlength\@fptop{0\p@ \@plus 1fil}
445 \setlength\@fpsep{8\p@ \@plus 2fil}
446 \setlength\@fpbot{0\p@ \@plus 1fil}
447 </10pt>
448 <*11pt>
449 \setlength\@fptop{0\p@ \@plus 1fil}
450 \setlength\@fpsep{8\p@ \@plus 2fil}
451 \setlength\@fpbot{0\p@ \@plus 1fil}
452 </11pt>
453 <*12pt>
454 \setlength\@fptop{0\p@ \@plus 1fil}
455 \setlength\@fpsep{10\p@ \@plus 2fil}
456 \setlength\@fpbot{0\p@ \@plus 1fil}
457 </12pt>

```

`\@dblftop` Double-column floats in two-column mode are handled with similar parameters.

```

\@dblfpsep 458 <*10pt>
\@dblfpbot 459 \setlength\@dblftop{0\p@ \@plus 1fil}
460 \setlength\@dblfpsep{8\p@ \@plus 2fil}
461 \setlength\@dblfpbot{0\p@ \@plus 1fil}
462 </10pt>
463 <*11pt>
464 \setlength\@dblftop{0\p@ \@plus 1fil}
465 \setlength\@dblfpsep{8\p@ \@plus 2fil}
466 \setlength\@dblfpbot{0\p@ \@plus 1fil}
467 </11pt>
468 <*12pt>
469 \setlength\@dblftop{0\p@ \@plus 1fil}
470 \setlength\@dblfpsep{10\p@ \@plus 2fil}
471 \setlength\@dblfpbot{0\p@ \@plus 1fil}
472 </12pt>
473 <*article | report | book>

```

## 6.4 Page Styles

The page style *foo* is defined by defining the command `\ps@foo`. This command should make only local definitions. There should be no stray spaces in the definition, since they could lead to mysterious extra spaces in the output (well, that's something that should be always avoided).

`\@evenhead` The `\ps@...` command defines the macros `\@oddhead`, `\@oddfoot`, `\@evenhead`, `\@oddhead` and `\@evenfoot` to define the running heads and feet—e.g., `\@oddhead` is the `\@evenfoot` macro to produce the contents of the heading box for odd-numbered pages. It is `\@oddfoot` called inside an `\hbox` of width `\textwidth`.

### 6.4.1 Marking conventions

To make headings determined by the sectioning commands, the page style defines the commands `\chaptermark`, `\sectionmark`, ..., where `\chaptermark{TEXT}` is called by `\chapter` to set a mark, and so on.

The `\...mark` commands and the `\...head` macros are defined with the help of the following macros. (All the `\...mark` commands should be initialized to no-ops.)

L<sup>A</sup>T<sub>E</sub>X extends T<sub>E</sub>X's `\mark` facility by producing two kinds of marks, a 'left' and a 'right' mark, using the following commands:

`\markboth{LEFT}{RIGHT}`: Adds both marks.  
`\markright{RIGHT}`: Adds a 'right' mark.  
`\leftmark`: Used in the `\@oddhead`, `\@oddfoot`, `\@evenhead` or `\@evenfoot` macros, it gets the current 'left' mark. `\leftmark` works like T<sub>E</sub>X's `\botmark` command.  
`\rightmark`: Used in the `\@oddhead`, `\@oddfoot`, `\@evenhead` or `\@evenfoot` macros, it gets the current 'right' mark. `\rightmark` works like T<sub>E</sub>X's `\firstmark` command.

The marking commands work reasonably well for right marks 'numbered within' left marks—e.g., the left mark is changed by a `\chapter` command and the right mark is changed by a `\section` command. However, it does produce somewhat anomalous results if two `\markboth`'s occur on the same page.

Commands like `\tableofcontents` that should set the marks in some page styles use a `\@mkboth` command, which is `\let` by the `pagestyle` command (`\ps@...`) to `\markboth` for setting the heading or to `\@gobbletwo` to do nothing.

### 6.4.2 Defining the page styles

The pagestyles *empty* and *plain* are defined in the L<sup>A</sup>T<sub>E</sub>X format.

`\ps@headings` The definition of the page style *headings* has to be different for two sided printing than it is for one sided printing.

```
474 \if@twoside
475   \def\ps@headings{%
```

The running feet are empty in this page style, the running head contains the page number and one of the marks.

```
476     \let\@oddfoot\@empty\let\@evenfoot\@empty
477     \def\@evenhead{\thepage\hfil\slshape\leftmark}%
478     \def\@oddhead{\slshape\rightmark}\hfil\thepage}%
```

When using this page style, the contents of the running head is determined by the chapter and section titles. So we `\let \@mkboth` to `\markboth`.

```
479     \let\@mkboth\markboth
```

For the article document class we define `\sectionmark` to clear the right mark and put the number of the section (when it is numbered) and its title in the left mark. The `\rightmark` is set by `\subsectionmark` to contain the subsection titles.

Note the use of `##1` for the parameter of the `\sectionmark` command, which will be defined when `\ps@headings` is executed.

```
480 \langle *article\rangle
```

```

481 \def\sectionmark##1{%
482   \markboth {\MakeUppercase{%
483     \ifnum \c@secnumdepth >\z@
484       \thesection\quad
485       \fi
486     ##1}}{}}%
487 \def\subsectionmark##1{%
488   \markright {%
489     \ifnum \c@secnumdepth >\@ne
490       \thesubsection\quad
491       \fi
492     ##1}}}}
493 \end{article}

```

In the report and book document classes we use the `\chaptermark` and `\sectionmark` macros to fill the running heads.

Note the use of `##1` for the parameter of the `\chaptermark` command, which will be defined when `\ps@headings` is executed.

```

494 \ifreport\book
495   \def\chaptermark##1{%
496     \markboth {\MakeUppercase{%
497       \ifnum \c@secnumdepth >\m@ne
498         \if@mainmatter
499           \@chapapp\ thechapter. \ %
500         \fi
501       \fi
502     ##1}}{}}%
503   \def\sectionmark##1{%
504     \markright {\MakeUppercase{%
505       \ifnum \c@secnumdepth >\z@
506         \thesection. \ %
507       \fi
508     ##1}}}}
509 \end{ifreport\book}

```

The definition of `\ps@headings` for one sided printing can be much simpler, because we treat even and odd pages the same. Therefore we don't need to define `\@even...`

```

510 \else
511   \def\ps@headings{%
512     \let\@oddfont\@empty
513     \def\@oddhead{\slshape\rightmark\hfil\thepage}%
514     \let\@mkboth\markboth

```

We use `\markright` now instead of `\markboth` as we did for two sided printing.

```

515 \end{article}
516 \def\sectionmark##1{%
517   \markright {\MakeUppercase{%
518     \ifnum \c@secnumdepth >\m@ne
519       \thesection\quad
520       \fi
521     ##1}}}}
522 \end{article}
523 \ifreport\book

```

```

524 \def\chaptermark##1{%
525 \markright {\MakeUppercase{%
526 \ifnum \c@secnumdepth >\m@ne
527 <book> \if@mainmatter
528 \@chapapp\ thechapter. \ %
529 <book> \fi
530 \fi
531 ##1}}}}
532 </report | book>
533 \fi

```

`\ps@myheadings` The definition of the page style *myheadings* is fairly simple because the user determines the contents of the running head himself by using the `\markboth` and `\markright` commands.

```

534 \def\ps@myheadings{%
535 \let\@oddfoot\@empty\let\@evenfoot\@empty
536 \def\@evenhead{\thepage\hfil\slshape\leftmark}%
537 \def\@oddhead{\slshape\rightmark\hfil\thepage}%

```

We have to make sure that the marking commands that are used by the chapter and section headings are disabled. We do this by letting them to a macro that gobbles its argument(s).

```

538 \let\@mkboth\@gobbletwo
539 <!article> \let\chaptermark\@gobble
540 \let\sectionmark\@gobble
541 <article> \let\subsectionmark\@gobble
542 }

```

## 7 Document Markup

### 7.1 The title

`\title` These three macros are provided by the L<sup>A</sup>T<sub>E</sub>X format to provide information about the title, author(s) and date of the document. The information is stored in internal control sequences. It is the task of the `\maketitle` command to use the information provided. The definitions of these macros are shown here for information.

```

543 % \DeclareRobustCommand*\title}[1]{\gdef\@title{#1}}
544 % \DeclareRobustCommand*\author}[1]{\gdef\@author{#1}}
545 % \DeclareRobustCommand*\date}[1]{\gdef\@date{#1}}

```

The `\date` macro gets today's date by default.

```

546 % \date{\today}

```

`\maketitle` The definition of `\maketitle` depends on whether a separate title page is made. This is the default for the report and book document classes, but for the article class it is optional.

When we are making a title page, we locally redefine `\footnotesize` and `footnoterule` to change the appearance of the footnotes that are produced by the `\thanks` command; these changes affect all footnotes.

```

547 \if@titlepage
548 \newcommand\maketitle{\begin{titlepage}%

```

```

549 \let\footnotesize\small
550 \let\footnoterule\relax
551 \let \footnote \thanks

```

We center the entire title vertically; the centering is set off a little by adding a `\vskip`. (In compatibility mode the page number is set to 0 by the titlepage environment to keep the behaviour of L<sup>A</sup>T<sub>E</sub>X 2.09 style files.)

```

552 \null\vfil
553 \vskip 60\p@

```

Then we set the title, in a `\LARGE` font; leave a little space and set the author(s) in a `\large` font. We do this inside a tabular environment to get them in a single column. Before the date we leave a little whitespace again.

```

554 \begin{center}%
555   {\LARGE \@title \par}%
556   \vskip 3em%
557   {\large
558     \lineskip .75em%
559     \begin{tabular}[t]{c}%
560       \@author
561     \end{tabular}\par}%
562   \vskip 1.5em%
563   {\large \@date \par}%      % Set date in \large size.
564 \end{center}\par

```

Then we call `\@thanks` to print the information that goes into the footnote and finish the page.

```

565 \@thanks
566 \vfil\null
567 \end{titlepage}%

```

We reset the `footnote` counter, disable `\thanks` and `\maketitle` and save some storage space by emptying the internal information macros.

```

568 \setcounter{footnote}{0}%
569 \global\let\thanks\relax
570 \global\let\maketitle\relax
571 \global\let\@thanks\@empty
572 \global\let\@author\@empty
573 \global\let\@date\@empty
574 \global\let\@title\@empty

```

After the title is set the declaration commands `\title`, etc. can vanish. The definition of `\and` makes only sense within the argument of `\author` so this can go as well.

```

575 \global\let\title\relax
576 \global\let\author\relax
577 \global\let\date\relax
578 \global\let\and\relax
579 }

```

When the title is not on a page of its own, the layout of the title is a little different. We use symbols to mark the footnotes and we have to deal with two-column documents.

Therefore we first start a new group to keep changes local. Then we redefine `\thefootnote` to use `\fnsymbol`; and change `\@makefnmark` so that footnotemarks have zero width (to make the centering of the author names look better).

```

580 \else
581   \newcommand\maketitle{\par
582     \begingroup
583       \renewcommand\thefootnote{\@fnsymbol\c@footnote}%
584       \def\makefnmark{\rlap{\@textsuperscript{\normalfont\@thefnmark}}}%
585       \long\def\makefntext##1{\parindent 1em\noindent
586         \hb@xt@1.8em{%
587           \hss\@textsuperscript{\normalfont\@thefnmark}}##1}%

```

If this is a two-column document we start a new page in two-column mode, with the title set to the full width of the text. The actual printing of the title information is left to `\@maketitle`.

```

588   \if@twocolumn
589     \ifnum \col@number=\@ne
590       \@maketitle
591     \else
592       \twocolumn[\@maketitle]%
593     \fi
594   \else

```

When this is not a two-column document we just start a new page, prevent floating objects from appearing on the top of this page and print the title information.

```

595     \newpage
596     \global\@topnum\z@ % Prevents figures from going at top of page.
597     \@maketitle
598     \fi

```

This page gets a *plain* layout. We call `\@thanks` to produce the footnotes.

```

599     \thispagestyle{plain}\@thanks

```

Now we can close the group, reset the *footnote* counter, disable `\thanks`, `\maketitle` and `\@maketitle` and save some storage space by emptying the internal information macros.

```

600   \endgroup
601   \setcounter{footnote}{0}%
602   \global\let\thanks\relax
603   \global\let\maketitle\relax
604   \global\let\@maketitle\relax
605   \global\let\@thanks\@empty
606   \global\let\@author\@empty
607   \global\let\@date\@empty
608   \global\let\@title\@empty
609   \global\let\title\relax
610   \global\let\author\relax
611   \global\let\date\relax
612   \global\let\and\relax
613 }

```

`\@maketitle` This macro takes care of formatting the title information when we have no separate title page.

We always start a new page, leave some white space and center the information. The title is set in a `\LARGE` font, the author names and the date in a `\large` font.

```

614 \def\@maketitle{%
615   \newpage
616   \null

```

```

617 \vskip 2em%
618 \begin{center}%
619 \let \footnote \thanks
620 {\LARGE \@title \par}%
621 \vskip 1.5em%
622 {\large
623 \lineskip .5em%
624 \begin{tabular}[t]{c}%
625 \@author
626 \end{tabular}\par}%
627 \vskip 1em%
628 {\large \@date}%
629 \end{center}%
630 \par
631 \vskip 1.5em}
632 \fi

```

## 7.2 Chapters and Sections

### 7.2.1 Building blocks

The definitions in this part of the class file make use of two internal macros, `\@startsection` and `\secdef`. To understand what is going on here, we describe their syntax.

The macro `\@startsection` has 6 required arguments, optionally followed by a \*, an optional argument and a required argument:

```

\@startsection<name><level><indent><beforeskip><afterskip><style> optional *
    [ <altheading> ] <heading>

```

It is a generic command to start a section, the arguments have the following meaning:

- <name>** The name of the user level command, e.g., ‘section’.
- <level>** A number, denoting the depth of the section – e.g., chapter=1, section = 2, etc. A section number will be printed if and only if  $\langle level \rangle \leq$  the value of the `secnumdepth` counter.
- <indent>** The indentation of the heading from the left margin
- <beforeskip>** The absolute value of this argument gives the skip to leave above the heading. If it is negative, then the paragraph indent of the text following the heading is suppressed.
- <afterskip>** If positive, this gives the skip to leave below the heading, else it gives the skip to leave to the right of a run-in heading.
- <style>** Commands to set the style of the heading.
- \* When this is missing the heading is numbered and the corresponding counter is incremented.
- <altheading>** Gives an alternative heading to use in the table of contents and in the running heads. This should not be present when the \* form is used.
- <heading>** The heading of the new section.

A sectioning command is normally defined to `\@startsection` and its first six arguments.

The macro `\secdef` can be used when a sectioning command is defined without using `\@startsection`. It has two arguments:

```
\secdef⟨unstarcmds⟩⟨starcmds⟩
```

⟨*unstarcmds*⟩ Used for the normal form of the sectioning command.

⟨*starcmds*⟩ Used for the \*-form of the sectioning command.

You can use `\secdef` as follows:

```
\def\chapter { ... \secdef \CMDA \CMDB }
\def\CMDA    [#1]#2{ ... } % Command to define
                    % \chapter[...]{...}
\def\CMDB    #1{ ... }   % Command to define
                    % \chapter*{...}
```

## 7.2.2 Mark commands

```
\chaptermark Default initializations of \...mark commands. These commands are used in the
\sectionmark definition of the page styles (see section 6.4.2) Most of them are already defined
\subsectionmark by the LATEX format, so they are only shown here.
\subsubsectionmark 633 ⟨!article⟩\newcommand*\chaptermark[1]{}
\paragraphmark     634 % \newcommand*\sectionmark[1]{}
\subparagraphmark  635 % \newcommand*\subsectionmark[1]{}
                   636 % \newcommand*\subsubsectionmark[1]{}
                   637 % \newcommand*\paragraphmark[1]{}
                   638 % \newcommand*\subparagraphmark[1]{}

```

## 7.2.3 Define Counters

```
\c@secnumdepth The value of the counter secnumdepth gives the depth of the highest-level sectioning
command that is to produce section numbers.
639 ⟨article⟩\setcounter{secnumdepth}{3}
640 ⟨article⟩\setcounter{secnumdepth}{2}
```

```
\c@part These counters are used for the section numbers. The macro
\c@chapter \newcounter{⟨newctr⟩}[⟨oldctr⟩]
\c@section defines⟨newctr⟩ to be a counter, which is reset to zero when counter ⟨oldctr⟩ is
\c@subsection stepped. Counter ⟨oldctr⟩ must already be defined.
\c@subsubsection 641 \newcounter {part}
\c@paragraph     642 ⟨article⟩\newcounter {section}
\c@subparagraph  643 ⟨*report | book⟩
                   644 \newcounter {chapter}
                   645 \newcounter {section}[chapter]
                   646 ⟨/report | book⟩
                   647 \newcounter {subsection}[section]
                   648 \newcounter {subsubsection}[subsubsection]
                   649 \newcounter {paragraph}[subsubsection]
                   650 \newcounter {subparagraph}[paragraph]
```

`\thepart` For any counter *CTR*, `\theCTR` is a macro that defines the printed version of counter *CTR*. It is defined in terms of the following macros:  
`\thechapter` counter *CTR*. It is defined in terms of the following macros:  
`\thesection` `\arabic{COUNTER}` prints the value of *COUNTER* as an arabic numeral.  
`\thesubsection` `\roman{COUNTER}` prints the value of *COUNTER* as a lowercase roman numeral.  
`\thesubsubsection` numeral.  
`\theparagraph` `\Roman{COUNTER}` prints the value of *COUNTER* as an uppercase roman numeral.  
`\thesubparagraph` numeral.  
`\alph{COUNTER}` prints the value of *COUNTER* as a lowercase letter: 1 = a, 2 = b, etc.  
`\Alph{COUNTER}` prints the value of *COUNTER* as an uppercase letter: 1 = A, 2 = B, etc.

Actually to save space the internal counter representations and the commands operating on those are used.

```

651 \renewcommand \thepart {\@Roman\c@part}
652 \langle article \rangle \renewcommand \thesection {\@arabic\c@section}
653 \langle *report | book \rangle
654 \renewcommand \thechapter {\@arabic\c@chapter}
655 \renewcommand \thesection {\thechapter.\@arabic\c@section}
656 \langle /report | book \rangle
657 \renewcommand \thesubsection {\thesection.\@arabic\c@subsection}
658 \renewcommand \thesubsubsection {\thesubsection.\@arabic\c@subsubsection}
659 \renewcommand \theparagraph {\thesubsubsection.\@arabic\c@paragraph}
660 \renewcommand \thesubparagraph {\theparagraph.\@arabic\c@subparagraph}

```

`\@chapapp` `\@chapapp` is initially defined to be ‘`\chaptername`’. The `\appendix` command redefines it to be ‘`\appendixname`’.

```
661 \langle report | book \rangle \newcommand \@chapapp {\chaptername}
```

## 7.2.4 Front Matter, Main Matter, and Back Matter

A book contains these three (logical) sections. The switch `\@mainmatter` is true iff we are processing Main Matter. When this switch is false, the `\chapter` command does not print chapter numbers.

Here we define the commands that start these sections.

`\frontmatter` This command starts Roman page numbering and turns off chapter numbering. Since this restarts the page numbering from 1, it should also ensure that a recto page is used.

```

662 \langle *book \rangle
663 \newcommand \frontmatter {%
664 %   \if@openright
665 %     \cleardoublepage
666 %   \else
667 %     \clearpage
668 %   \fi
669 %   \@mainmatterfalse
670 %   \pagenumbering{roman}}

```

`\mainmatter` This command clears the page, starts arabic page numbering and turns on chapter numbering. Since this restarts the page numbering from 1, it should also ensure that a recto page is used.

```
671 \newcommand \mainmatter {%
```

```

672 % \if@openright
673 \cleardoublepage
674 % \else
675 % \clearpage
676 % \fi
677 \@mainmattertrue
678 \pagenumbering{arabic}}

```

`\backmatter` This clears the page, turns off chapter numbering and leaves page numbering unchanged.

```

679 \newcommand\backmatter{%
680 \if@openright
681 \cleardoublepage
682 \else
683 \clearpage
684 \fi
685 \@mainmatterfalse}
686 </book>

```

### 7.2.5 Parts

`\part` The command to start a new part of our document.

In the article class the definition of `\part` is rather simple; we start a new paragraph, add a little white space, suppress the indentation of the first paragraph and make use of `\secdef`. As in other sectioning commands (cf. `\@startsection` in the L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> kernel), we need to check the `@noskipsec` switch and force horizontal mode if it is set.

```

687 <*article>
688 \newcommand\part{%
689 \if@noskipsec \leavevmode \fi
690 \par
691 \addvspace{4ex}%
692 \@afterindentfalse
693 \secdef\@part\@spart}
694 </article>

```

For the report and book classes we things a bit different.

We start a new (righthand) page and use the *plain* pagestyle.

```

695 <*report | book>
696 \newcommand\part{%
697 \if@openright
698 \cleardoublepage
699 \else
700 \clearpage
701 \fi
702 \thispagestyle{plain}%

```

When we are making a two-column document, this will be a one column page. We use `@tempswa` to remember to switch back to two columns.

```

703 \if@twocolumn
704 \onecolumn
705 \@tempswatrue
706 \else
707 \@tempswafalse

```

```
708 \fi
```

We need an empty box to prevent the fil glue from disappearing.

```
709 \null\vfil
```

Here we use `\secdef` to indicate which commands to use to make the actual heading.

```
710 \secdef\@part\@spart}
```

```
711 </report | book)
```

`\@part` This macro does the actual formatting of the title of the part. Again the macro is differently defined for the article document class than for the document classes report and book.

When `secnumdepth` is larger than  $-1$  for the document class article, we have a numbered part, otherwise it is unnumbered.

```
712 <*article)
```

```
713 \def\@part[#1]#2{%
```

```
714   \ifnum \c@secnumdepth >\m@ne
```

```
715     \refstepcounter{part}%
```

```
716     \addcontentsline{toc}{part}{\thepart\hspace{1em}#1}%
```

```
717   \else
```

```
718     \addcontentsline{toc}{part}{#1}%
```

```
719   \fi
```

We print the title flush left in the article class. Also we prevent breaking between lines and reset the font.

```
720   {\parindent \z@ \raggedright
```

```
721     \interlinepenalty \@M
```

```
722     \normalfont
```

When this is a numbered part we have to print the number and the title. The `\nobreak` should prevent a page break here.

```
723     \ifnum \c@secnumdepth >\m@ne
```

```
724       \Large\bfseries \partname\nobreakspace\thepart
```

```
725       \par\nobreak
```

```
726     \fi
```

```
727     \huge \bfseries #2%
```

Now we empty the mark registers, leave some white space and let `\@afterheading` take care of suppressing the indentation.

```
728     \markboth{}{\par}%
```

```
729     \nobreak
```

```
730     \vskip 3ex
```

```
731     \@afterheading}
```

```
732 </article)
```

When `secnumdepth` is larger than  $-2$  for the document class report and book, we have a numbered part, otherwise it is unnumbered.

```
733 <*report | book)
```

```
734 \def\@part[#1]#2{%
```

```
735   \ifnum \c@secnumdepth >-2\relax
```

```
736     \refstepcounter{part}%
```

```
737     \addcontentsline{toc}{part}{\thepart\hspace{1em}#1}%
```

```
738   \else
```

```
739     \addcontentsline{toc}{part}{#1}%
```

```
740   \fi
```

We empty the mark registers and center the title on the page in the report and book document classes. Also we prevent breaking between lines and reset the font.

```
741 \markboth{}{}%
742 {\centering
743 \interlinepenalty \@M
744 \normalfont
```

When this is a numbered part we have to print the number.

```
745 \ifnum \c@secnumdepth >-2\relax
746 \huge\bfseries \partname\nobreakspace\thepart
747 \par
```

We leave some space before we print the title and leave the finishing up to `\@endpart`.

```
748 \vskip 20\p@
749 \fi
750 \Huge \bfseries #2\par}%
751 \@endpart}
752 </report | book>
```

`\@spart` This macro does the actual formatting of the title of the part when the star form of the user command was used. In this case we *never* print a number. Otherwise the formatting is the same.

The differences between the definition of this macro in the article document class and in the report and book document classes are similar as they were for `\@part`.

```
753 <*article>
754 \def\@spart#1{%
755 {\parindent \z@ \raggedright
756 \interlinepenalty \@M
757 \normalfont
758 \huge \bfseries #1\par}%
759 \nobreak
760 \vskip 3ex
761 \@afterheading}
762 </article>
763 <*report | book>
764 \def\@spart#1{%
765 {\centering
766 \interlinepenalty \@M
767 \normalfont
768 \Huge \bfseries #1\par}%
769 \@endpart}
770 </report | book>
```

`\@endpart` This macro finishes the part page, for both `\@part` and `\@spart`.

First we fill the current page.

```
771 <*report | book>
772 \def\@endpart{\vfil\newpage
```

Then, when we are in twosided mode and chapters are supposed to be on right hand sides, we produce a completely blank page.

```
773 \if@twoside
774 \if@openright
```

```

775             \null
776             \thispagestyle{empty}%
777             \newpage
778             \fi
779             \fi

```

When this was a two-column document we have to switch back to two-column mode.

```

780             \if@tempwa
781             \twocolumn
782             \fi}
783 \</report | book>

```

## 7.2.6 Chapters

`\chapter` A chapter should always start on a new page therefore we start by calling `\clearpage` and setting the pagestyle for this page to *plain*.

```

784 \<*report | book>
785 \newcommand\chapter{\if@openright\cleardoublepage\else\clearpage\fi
786             \thispagestyle{plain}}%

```

Then we prevent floats from appearing at the top of this page because it looks weird to see a floating object above a chapter title.

```

787             \global\@topnum\z@

```

Then we suppress the indentation of the first paragraph by setting the switch `\@afterindent` to `false`. We use `\secdef` to specify the macros to use for actually setting the chapter title.

```

788             \@afterindentfalse
789             \secdef\@chapter\@schapter}

```

`\@chapter` This macro is called when we have a numbered chapter. When `secnumdepth` is larger than `-1` and, in the book class, `\@mainmatter` is true, we display the chapter number. We also inform the user that a new chapter is about to be typeset by writing a message to the terminal.

```

790 \def\@chapter[#1]#2{\ifnum \c@secnumdepth >\m@ne
791 \<book>             \if@mainmatter
792                     \refstepcounter{chapter}%
793                     \typeout{\@chapapp\space\thechapter.}%
794                     \addcontentsline{toc}{chapter}%
795                     {\protect\numberline{\thechapter}#1}%
796 \<*book>
797                     \else
798                     \addcontentsline{toc}{chapter}{#1}%
799                     \fi
800 \</book>
801                     \else
802                     \addcontentsline{toc}{chapter}{#1}%
803                     \fi

```

After having written an entry to the table of contents we store the (alternative) title of this chapter with `\chaptermark` and add some white space to the lists of figures and tables.

```

804             \chaptermark{#1}%

```

```

805             \addtocontents{lof}{\protect\addvspace{10\p}}%
806             \addtocontents{lot}{\protect\addvspace{10\p}}%

```

Then we call upon `\@makechapterhead` to format the actual chapter title. We have to do this in a special way when we are in two-column mode in order to have the chapter title use the entire `\textwidth`. In one-column mode we call `\@afterheading` which takes care of suppressing the indentation.

```

807             \iftwocolumn
808                 \topnewpage[\@makechapterhead{#2}]%
809             \else
810                 \@makechapterhead{#2}%
811                 \@afterheading
812             \fi}

```

`\@makechapterhead` The macro above uses `\@makechapterhead<text>` to format the heading of the chapter.

We begin by leaving some white space. Then we open a group in which we have a paragraph indent of 0pt, and in which we have the text set ragged right. We also reset the font.

```

813 \def\@makechapterhead#1{%
814   \vspace*{50\p}%
815   {\parindent \z@ \raggedright \normalfont

```

Then we check whether the number of the chapter has to be printed. If so we leave some whitespace between the chapter number and its title.

```

816     \ifnum \c@secnumdepth >\m@ne
817 <book>     \ifmainmatter
818             \huge\bfseries \@chapapp\space \thechapter
819             \par\nobreak
820             \vskip 20\p@
821 <book>     \fi
822     \fi

```

Now we set the title in a large bold font. We prevent a pagebreak from occurring in the middle of or after the title. Finally we leave some whitespace before the text begins.

```

823     \interlinepenalty\@M
824     \Huge \bfseries #1\par\nobreak
825     \vskip 40\p@
826   }}

```

`\@schapter` This macro is called when we have an unnumbered chapter. It is much simpler than `\@chapter` because it only needs to typeset the chapter title.

```

827 \def\@schapter#1{\iftwocolumn
828     \topnewpage[\@makeschapterhead{#1}]%
829 \else
830     \@makeschapterhead{#1}%
831     \@afterheading
832 \fi}

```

`\@makeschapterhead` The macro above uses `\@makeschapterhead<text>` to format the heading of the chapter. It is similar to `\@makechapterhead` except that it never has to print a chapter number.

```

833 \def\@makeschapterhead#1{%
834   \vspace*{50\p@}%
835   {\parindent \z@ \raggedright
836     \normalfont
837     \interlinepenalty\@M
838     \Huge \bfseries #1\par\nobreak
839     \vskip 40\p@
840   }}
841 \</report | book>

```

## 7.2.7 Lower level headings

These commands all make use of `\@startsection`.

`\section` This gives a normal heading with white space above and below the heading, the title set in `\Large\bfseries`, and no indentation on the first paragraph.

```

842 \newcommand\section{\@startsection {section}{1}{\z@}%
843                                     {-3.5ex \@plus -1ex \@minus -.2ex}%
844                                     {2.3ex \@plus .2ex}%
845                                     {\normalfont\Large\bfseries}}

```

`\subsection` This gives a normal heading with white space above and below the heading, the title set in `\large\bfseries`, and no indentation on the first paragraph.

```

846 \newcommand\subsection{\@startsection{subsection}{2}{\z@}%
847                                     {-3.25ex\@plus -1ex \@minus -.2ex}%
848                                     {1.5ex \@plus .2ex}%
849                                     {\normalfont\large\bfseries}}

```

`\subsubsection` This gives a normal heading with white space above and below the heading, the title set in `\normalsize\bfseries`, and no indentation on the first paragraph.

```

850 \newcommand\subsubsection{\@startsection{subsubsection}{3}{\z@}%
851                                     {-3.25ex\@plus -1ex \@minus -.2ex}%
852                                     {1.5ex \@plus .2ex}%
853                                     {\normalfont\normalsize\bfseries}}

```

`\paragraph` This gives a run-in heading with white space above and to the right of the heading, the title set in `\normalsize\bfseries`.

```

854 \newcommand\paragraph{\@startsection{paragraph}{4}{\z@}%
855                                     {3.25ex \@plus 1ex \@minus .2ex}%
856                                     {-1em}%
857                                     {\normalfont\normalsize\bfseries}}

```

`\subparagraph` This gives an indented run-in heading with white space above and to the right of the heading, the title set in `\normalsize\bfseries`.

```

858 \newcommand\subparagraph{\@startsection{subparagraph}{5}{\parindent}%
859                                     {3.25ex \@plus 1ex \@minus .2ex}%
860                                     {-1em}%
861                                     {\normalfont\normalsize\bfseries}}

```

## 7.3 Lists

### 7.3.1 General List Parameters

The following commands are used to set the default values for the list environment's parameters. See the L<sup>A</sup>T<sub>E</sub>X manual for an explanation of the meanings of the parameters. Defaults for the list environment are set as follows. First, `\rightmargin`, `\listparindent` and `\itemindent` are set to 0pt. Then, for a Kth level list, the command `\@listK` is called, where 'K' denotes 'i', 'i', ... , 'vi'. (I.e., `\@listiii` is called for a third-level list.) By convention, `\@listK` should set `\leftmargin` to `\leftmarginK`.

```
\leftmargin When we are in two-column mode some of the margins are set somewhat smaller.
\leftmargini 862 \if@twocolumn
\leftmarginii 863 \setlength\leftmargini {2em}
\leftmarginiii 864 \else
\leftmarginiv 865 \setlength\leftmargini {2.5em}
\leftmarginv 866 \fi
\leftmarginvi Until the whole of the parameter setting in these files is rationalised, we need to
set the value of \leftmargin at this outer level.
```

```
867 \leftmargin \leftmargini
```

The following three are calculated so that they are larger than the sum of `\labelsep` and the width of the default labels (which are '(m)', 'vii.' and 'M.').

```
868 \setlength\leftmarginii {2.2em}
869 \setlength\leftmarginiii {1.87em}
870 \setlength\leftmarginiv {1.7em}
871 \if@twocolumn
872 \setlength\leftmarginv {.5em}
873 \setlength\leftmarginvi {.5em}
874 \else
875 \setlength\leftmarginv {1em}
876 \setlength\leftmarginvi {1em}
877 \fi
```

```
\labelsep \labelsep is the distance between the label and the text of an item; \labelwidth
\labelwidth is the width of the label.
```

```
878 \setlength \labelsep {.5em}
879 \setlength \labelwidth{\leftmargini}
880 \addtolength\labelwidth{-\labelsep}
```

```
\partopsep When the user leaves a blank line before the environment an extra vertical space
of \partopsep is inserted, in addition to \parskip and \topsep.
```

```
881 </article | report | book>
882 <10pt>\setlength\partopsep{2\p@ \@plus 1\p@ \@minus 1\p@}
883 <11pt>\setlength\partopsep{3\p@ \@plus 1\p@ \@minus 1\p@}
884 <12pt>\setlength\partopsep{3\p@ \@plus 2\p@ \@minus 2\p@}
```

```
\@beginparpenalty These penalties are inserted before and after a list or paragraph environment.
\@endparpenalty They are set to a bonus value to encourage page breaking at these points.
```

```
\@itempenalty This penalty is inserted between list items.
885 <*article | report | book>
```

```

886 \@beginparpenalty -\@lowpenalty
887 \@endparpenalty -\@lowpenalty
888 \@itempenalty -\@lowpenalty
889 </article | report | book>

```

`\@listi` `\@listi` defines the values of `\leftmargin`, `\parsep`, `\topsep`, `\itemsep`, etc. `\@listI` for the lists that appear on top-level. Its definition is modified by the font-size commands (eg within `\small` the list parameters get “smaller” values).

For this reason `listI` is defined to hold a saved copy of `listi` so that `\normalsize` can switch all parameters back.

```

890 < *10pt | 11pt | 12pt >
891 \def\@listi{\leftmargin\leftmarginI
892 < *10pt >
893         \parsep 4\p@ \@plus2\p@ \@minus\p@
894         \topsep 8\p@ \@plus2\p@ \@minus4\p@
895         \itemsep4\p@ \@plus2\p@ \@minus\p@}
896 < /10pt >
897 < *11pt >
898         \parsep 4.5\p@ \@plus2\p@ \@minus\p@
899         \topsep 9\p@ \@plus3\p@ \@minus5\p@
900         \itemsep4.5\p@ \@plus2\p@ \@minus\p@}
901 < /11pt >
902 < *12pt >
903         \parsep 5\p@ \@plus2.5\p@ \@minus\p@
904         \topsep 10\p@ \@plus4\p@ \@minus6\p@
905         \itemsep5\p@ \@plus2.5\p@ \@minus\p@}
906 < /12pt >
907 \let\@listI\@listi

```

We initialise the parameters although strictly speaking that is not necessary.

```

908 \@listi

```

`\@listii` Here are the same macros for the higher level lists. Note that they don’t have `\@listiii` saved versions and are not modified by the font size commands. In other words `\@listiv` this class assumes that nested lists only appear in `\normalsize`, i.e. the main `\@listv` document size.

```

\@listvi 909 \def\@listii {\leftmargin\leftmarginii
910         \labelwidth\leftmarginii
911         \advance\labelwidth-\labelsep
912 < *10pt >
913         \topsep 4\p@ \@plus2\p@ \@minus\p@
914         \parsep 2\p@ \@plus\p@ \@minus\p@
915 < /10pt >
916 < *11pt >
917         \topsep 4.5\p@ \@plus2\p@ \@minus\p@
918         \parsep 2\p@ \@plus\p@ \@minus\p@
919 < /11pt >
920 < *12pt >
921         \topsep 5\p@ \@plus2.5\p@ \@minus\p@
922         \parsep 2.5\p@ \@plus\p@ \@minus\p@
923 < /12pt >
924         \itemsep \parsep}
925 \def\@listiii{\leftmargin\leftmarginiii

```

```

926         \labelwidth\leftmarginiii
927         \advance\labelwidth-\labelsep
928 <10pt>         \topsep      2\p@ \@plus\p@\@minus\p@
929 <11pt>         \topsep      2\p@ \@plus\p@\@minus\p@
930 <12pt>         \topsep      2.5\p@\@plus\p@\@minus\p@
931         \parsep      \z@
932         \partopsep  \p@ \@plus\z@ \@minus\p@
933         \itemsep    \topsep}
934 \def\@listiv {\leftmargin\leftmarginiv
935             \labelwidth\leftmarginiv
936             \advance\labelwidth-\labelsep}
937 \def\@listv  {\leftmargin\leftmarginv
938             \labelwidth\leftmarginv
939             \advance\labelwidth-\labelsep}
940 \def\@listvi {\leftmargin\leftmarginvi
941             \labelwidth\leftmarginvi
942             \advance\labelwidth-\labelsep}
943 </10pt | 11pt | 12pt>

```

### 7.3.2 Enumerate

The enumerate environment uses four counters: *enumi*, *enumii*, *enumiii* and *enumiv*, where *enumN* controls the numbering of the Nth level enumeration.

```

\theenumi The counters are already defined in the LATEX format, but their representation is
\theenumii changed here.
\theenumiii
\theenumiv 944 <*article | report | book>
          945 \renewcommand\theenumi{\@arabic\c@enumi}
          946 \renewcommand\theenumii{\@alph\c@enumii}
          947 \renewcommand\theenumiii{\@roman\c@enumiii}
          948 \renewcommand\theenumiv{\@Alph\c@enumiv}

```

```

\labelenumi The label for each item is generated by the commands
\labelenumii \labelenumi ... \labelenumiv.
\labelenumiii 949 \newcommand\labelenumi{\theenumi.}
\labelenumiv 950 \newcommand\labelenumii{(\theenumii)}
          951 \newcommand\labelenumiii{\theenumiii.}
          952 \newcommand\labelenumiv{\theenumiv.}

```

```

\p@enumii The expansion of \p@enumN\theenumN defines the output of a \ref command
\p@enumiii when referencing an item of the Nth level of an enumerated list.
\p@enumiv 953 \renewcommand\p@enumii{\theenumi}
          954 \renewcommand\p@enumiii{\theenumi(\theenumii)}
          955 \renewcommand\p@enumiv{\p@enumiii\theenumiii}

```

### 7.3.3 Itemize

Itemization is controlled by four commands: `\labelitemi`, `\labelitemii`, `\labelitemiii`, and `\labelitemiv`, which define the labels of the various itemization levels: the symbols used are bullet, bold en-dash, centered asterisk and centred dot.

```

956 \newcommand\labelitemi {\labelitemfont \textbullet}

```

```

957 \newcommand\labelitemii {\labelitemfont \bfseries \textendash}
958 \newcommand\labelitemiii{\labelitemfont \textasteriskcentered}
959 \newcommand\labelitemiv {\labelitemfont \textperiodcentered}

```

`\labelitemfont` The default definition for `\labelitemfont` is to reset the font to `\normalfont` so that always the same symbol is produced regardless of surrounding conditions.

Possible alternatives would be, for example,

```

\renewcommand\labelitemfont
  {\normalfont\fontfamily{lmss}\selectfont}
\renewcommand\labelitemfont
  {\rmfamily\normalshape}

```

the first would use symbols from Latin Modern Sans, the second would only allow changes in the font series so that an `itemize` in a bold context would produce bolder symbols.

```

960 \newcommand\labelitemfont{\normalfont}

```

### 7.3.4 Description

`description` (*env.*) The description environment is defined here – while the `itemize` and `enumerate` environments are defined in the L<sup>A</sup>T<sub>E</sub>X format.

```

961 \newenvironment{description}
962     {\list{}{\labelwidth\z@ \itemindent-\leftmargin
963             \let\makelabel\descriptionlabel}}
964     {\endlist}

```

`\descriptionlabel` To change the formatting of the label, you must redefine `\descriptionlabel`.

```

965 \newcommand*\descriptionlabel[1]{\hspace\labelsep
966     \normalfont\bfseries #1}

```

## 7.4 Defining new environments

### 7.4.1 Abstract

`abstract` (*env.*) When we are producing a separate titlepage we also put the abstract on a page of its own. It will be centred vertically on the page.

Note that this environment is not defined for books.

```

967 % \changes{v1.3m}{1995/10/23}{Added setting of \cs{beginparpenalty} to
968 %   discourage page break before abstract heading.}
969 <*article | report>
970 \if@titlepage
971   \newenvironment{abstract}{%
972     \titlepage
973     \null\vfil
974     \@beginparpenalty\@lowpenalty
975     \begin{center}%
976       \bfseries \abstractname
977       \@endparpenalty\@M
978     \end{center}}%
979   {\par\vfil\null\endtitlepage}

```

When we are not making a separate titlepage –the default for the article document class– we have to check if we are in two-column mode. In that case the abstract is as a `\section*`, otherwise the quotation environment is used to typeset the abstract.

```

980 \else
981   \newenvironment{abstract}{%
982     \if@twocolumn
983       \section*{\abstractname}%
984     \else
985       \small
986       \begin{center}%
987         {\bfseries \abstractname\vspace{-.5em}\vspace{\z@}}%
988       \end{center}%
989       \quotation
990     \fi}
991   {\if@twocolumn\else\endquotation\fi}
992 \fi
993 </article | report>

```

#### 7.4.2 Verse

**verse** (*env.*) The verse environment is defined by making clever use of the list environment’s parameters. The user types `\\` to end a line. This is implemented by `\let\ing \\ equal \@centercr`.

```

994 \newenvironment{verse}
995     {\let\\ \@centercr
996     \list{}{\itemsep \z@
997             \itemindent -1.5em%
998             \listparindent\itemindent
999             \rightmargin \leftmargin
1000            \advance\leftmargin 1.5em}%
1001     \item\relax}
1002     {\endlist}

```

#### 7.4.3 Quotation

**quotation** (*env.*) The quotation environment is also defined by making clever use of the list environment’s parameters. The lines in the environment are set smaller than `\textwidth`. The first line of a paragraph inside this environment is indented.

```

1003 \newenvironment{quotation}
1004     {\list{}{\listparindent 1.5em%
1005             \itemindent \listparindent
1006             \rightmargin \leftmargin
1007             \parsep \z@ \@plus\p@}%
1008     \item\relax}
1009     {\endlist}

```

#### 7.4.4 Quote

**quote** (*env.*) The quote environment is like the quotation environment except that paragraphs are not indented.

```

1010 \newenvironment{quote}

```

```

1011         {\list}{\rightmargin\leftmargin}%
1012         \item\relax}
1013         {\endlist}

```

#### 7.4.5 Theorem

This document class does not define its own theorem environments, the defaults, supplied by the L<sup>A</sup>T<sub>E</sub>X format are available.

#### 7.4.6 Titlepage

`titlepage` (*env.*) In the normal environments, the titlepage environment does nothing but start and end a page, and inhibit page numbers. When L<sup>A</sup>T<sub>E</sub>X is in two-column mode, the environment temporarily switches to one-column mode. In the report class, it also resets the page number to one, and then, in two-column mode, sets it back to one at the end. For the book class the environment makes sure that the title page is on a recto page by issuing a `\cleardoublepage`-command. In compatibility mode, it sets the page number to zero. This is incorrect since it results in using the page parameters for a right-hand page but it is the way it was.

First we do give the definition for compatibility mode.

```

1014 \if@compatibility
1015   \newenvironment{titlepage}
1016     {%
1017   <book>      \cleardoublepage
1018             \if@twocolumn
1019             \@restonecoltrue\onecolumn
1020             \else
1021             \@restonecolfalse\newpage
1022             \fi
1023             \thispagestyle{empty}%
1024             \setcounter{page}\z@
1025     }%
1026     {\if@restonecol\twocolumn \else \newpage \fi
1027     }

```

And here is the one for native L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>.

```

1028 \else
1029   \newenvironment{titlepage}
1030     {%
1031   <book>      \cleardoublepage
1032             \if@twocolumn
1033             \@restonecoltrue\onecolumn
1034             \else
1035             \@restonecolfalse\newpage
1036             \fi
1037             \thispagestyle{empty}%
1038             \setcounter{page}\@ne
1039     }%
1040     {\if@restonecol\twocolumn \else \newpage \fi

```

If we are not in two-side mode the first page after the title page should also get page number 1.

```

1041     \if@twoside\else
1042     \setcounter{page}\@ne

```

```

1043     \fi
1044   }
1045 \fi

```

### 7.4.7 Appendix

`\appendix` The `\appendix` command is not really an environment, it is a macro that makes some changes in the way things are done.

In the article document class the `\appendix` command must do the following:

- reset the section and subsection counters to zero,
- redefine `\thesection` to produce alphabetic appendix numbers. This redefinition is done globally to ensure that it survives even if `\appendix` is issued within an environment such as `multicols`.

```

1046 <*article>
1047 \newcommand\appendix{\par
1048   \setcounter{section}{0}%
1049   \setcounter{subsection}{0}%
1050   \gdef\thesection{\@Alph\c@section}}
1051 </article>

```

In the report and book document classes the `\appendix` command must do the following:

- reset the chapter and section counters to zero,
- set `\@chapapp` to `\appendixname` (for messages),
- redefine the chapter counter to produce appendix numbers,
- possibly redefine the `\chapter` command if appendix titles and headings are to look different from chapter titles and headings. This redefinition is done globally to ensure that it survives even if `\appendix` is issued within an environment such as `multicols`.

```

1052 <*report | book>
1053 \newcommand\appendix{\par
1054   \setcounter{chapter}{0}%
1055   \setcounter{section}{0}%
1056   \gdef\@chapapp{\appendixname}%
1057   \gdef\thechapter{\@Alph\c@chapter}}
1058 </report | book>

```

## 7.5 Setting parameters for existing environments

### 7.5.1 Array and tabular

`\arraycolsep` The columns in an array environment are separated by `2\arraycolsep`.

```
1059 \setlength\arraycolsep{5\p@}
```

`\tabcolsep` The columns in an tabular environment are separated by `2\tabcolsep`.

```
1060 \setlength\tabcolsep{6\p@}
```

`\arrayrulewidth` The width of rules in the array and tabular environments is given by `\arrayrulewidth`.

```
1061 \setlength\arrayrulewidth{.4\p@}
```

`\doublerulesep` The space between adjacent rules in the array and tabular environments is given by `\doublerulesep`.

```
1062 \setlength\doublerulesep{2\p@}
```

### 7.5.2 Tabbing

`\tabbingsep` This controls the space that the `\` command puts in. (See L<sup>A</sup>T<sub>E</sub>X manual for an explanation.)

```
1063 \setlength\tabbingsep{\labelsep}
```

### 7.5.3 Minipage

`\@minipagerestore` The macro `\@minipagerestore` is called upon entry to a minipage environment to set up things that are to be handled differently inside a minipage environment. In the current classes, it does nothing.

`\@mpfootins` Minipages have their own footnotes; `\skip\@mpfootins` plays same rôle for footnotes in a minipage as `\skip\footins` does for ordinary footnotes.

```
1064 \skip\@mpfootins = \skip\footins
```

### 7.5.4 Framed boxes

`\fboxsep` The space left by `\fbox` and `\framebox` between the box and the text in it.

`\fboxrule` The width of the rules in the box made by `\fbox` and `\framebox`.

```
1065 \setlength\fboxsep{3\p@}
```

```
1066 \setlength\fboxrule{.4\p@}
```

### 7.5.5 Equation and eqnarray

`\theequation` When within chapters, the equation counter will be reset at the beginning of a new chapter and the equation number will be prefixed by the chapter number.

This code must follow the `\chapter` definition or, more exactly, the definition of the chapter counter.

```
1067 <article>\renewcommand \theequation {\@arabic\c@equation}
```

```
1068 <*report|book>
```

```
1069 \@addtoreset {equation}{chapter}
```

```
1070 \renewcommand\theequation
```

```
1071   {\ifnum \c@chapter>\z@ \thechapter.\fi \@arabic\c@equation}
```

```
1072 </report|book>
```

`\jot` `\jot` is the extra space added between lines of an `eqnarray` environment. The default value is used.

```
1073 % \setlength\jot{3pt}
```

`\@eqnnum` The macro `\@eqnnum` defines how equation numbers are to appear in equations. Again the default is used.

```
1074 % \def\@eqnnum{(\theequation)}
```

## 7.6 Floating objects

The L<sup>A</sup>T<sub>E</sub>X format only defines a number of tools with which floating objects can be defined. This is done in the document class. It needs to define the following macros for each floating object of type TYPE (e.g., TYPE = figure).

`\fps@TYPE` The default placement specifier for floats of type TYPE.

`\ftype@TYPE` The type number for floats of type TYPE. Each TYPE has associated a unique positive TYPE number, which is a power of two. E.g., figures might have type number 1, tables type number 2, programs type number 4, etc.

`\ext@TYPE` The file extension indicating the file on which the contents list for float type TYPE is stored. For example, `\ext@figure = 'lof'`.

`\fnum@TYPE` A macro to generate the figure number for a caption. For example, `\fnum@TYPE == 'Figure \thefigure'`.

`\@makecaption<num><text>` A macro to make a caption, with `<num>` the value produced by `\fnum@...` and `<text>` the text of the caption. It can assume it's in a `\parbox` of the appropriate width. This will be used for *all* floating objects.

The actual environment that implements a floating object such as a figure is defined using the macros `\@float` and `\end@float`, which are defined in the L<sup>A</sup>T<sub>E</sub>X format.

An environment that implements a single-column floating object is started with `\@float{TYPE}[<placement>]` of type TYPE with `<placement>` as the placement specifier. The default value of `<PLACEMENT>` is defined by `\fps@TYPE`.

The environment is ended by `\end@float`. E.g., `\figure == \@floatfigure, \endfigure == \end@float`.

### 7.6.1 Figure

Here is the implementation of the figure environment.

`\c@figure` First we have to allocate a counter to number the figures.

In the report and book document classes figures within chapters are numbered per chapter.

```
1075 <*article>
1076 \newcounter{figure}
1077 \renewcommand \thefigure {\@arabic\c@figure}
1078 </article>
1079 <*report | book>
1080 \newcounter{figure}[chapter]
1081 \renewcommand \thefigure
1082     {\ifnum \c@chapter>\z@ \thechapter.\fi \@arabic\c@figure}
1083 </report | book>
```

`\fps@figure` Here are the parameters for the floating objects of type 'figure'.

```
\ftype@figure 1084 \def\fps@figure{tbp}
\ext@figure    1085 \def\ftype@figure{1}
\num@figure    1086 \def\ext@figure{lof}
1087 \def\fnum@figure{\figurename\nobreakspace\thefigure}
```

`figure` (*env.*) And the definition of the actual environment. The form with the `*` is used for `figure*` (*env.*) double-column figures.

```
1088 \newenvironment{figure}
1089     {\@float{figure}}
1090     {\end@float}
1091 \newenvironment{figure*}
1092     {\@dblfloat{figure}}
1093     {\end@dblfloat}
```

## 7.6.2 Table

Here is the implementation of the table environment. It is very much the same as the figure environment.

`\c@table` First we have to allocate a counter to number the tables.

In the report and book document classes tables within chapters are numbered per chapter.

```
1094 <*article>
1095 \newcounter{table}
1096 \renewcommand\thetable{\@arabic\c@table}
1097 </article>
1098 <*report | book>
1099 \newcounter{table}[chapter]
1100 \renewcommand \thetable
1101     {\ifnum \c@chapter>\z@ \thechapter.\fi \@arabic\c@table}
1102 </report | book>
```

`\fps@table` Here are the parameters for the floating objects of type ‘table’.

```
\ftype@table 1103 \def\fps@table{tbp}
\ext@table 1104 \def\ftype@table{2}
\num@table 1105 \def\ext@table{lot}
1106 \def\fnm@table{\tablename\nobreakspace\thetable}
```

`table` (*env.*) And the definition of the actual environment. The form with the `*` is used for `table*` (*env.*) double-column tables.

```
1107 \newenvironment{table}
1108     {\@float{table}}
1109     {\end@float}
1110 \newenvironment{table*}
1111     {\@dblfloat{table}}
1112     {\end@dblfloat}
```

## 7.6.3 Captions

`\@makecaption` The `\caption` command calls `\@makecaption` to format the caption of floating objects. It gets two arguments, `<number>`, the number of the floating object and `<text>`, the text of the caption. Usually `<number>` contains a string such as ‘Figure 3.2’. The macro can assume it is called inside a `\parbox` of right width, with `\normalsize`.

`\abovecaptionskip` These lengths contain the amount of white space to leave above and below the `\belowcaptionskip` caption.

```

1113 \newlength\abovecaptionskip
1114 \newlength\belowcaptionskip
1115 \setlength\abovecaptionskip{10\p@}
1116 \setlength\belowcaptionskip{0\p@}

```

The definition of this macro is `\long` in order to allow more than one paragraph in a caption.

```

1117 \long\def\makecaption#1#2{%
1118   \vskip\abovecaptionskip

```

We want to see if the caption fits on one line on the page, therefore we first typeset it in a temporary box.

```

1119   \sbox\tempboxa{#1: #2}%

```

We can then measure its width. If that is larger than the current `\hsize` we typeset the caption as an ordinary paragraph.

```

1120   \ifdim \wd\tempboxa >\hsize
1121     #1: #2\par

```

If the caption fits, we center it. Because this uses an `\hbox` directly in vertical mode, it does not execute the `\everypar` tokens; the only thing that could be needed here is resetting the ‘minipage flag’ so we do this explicitly.

```

1122   \else
1123     \global \@minipagefalse
1124     \hb@xt@\hsize{\hfil\box\tempboxa\hfil}%
1125   \fi
1126   \vskip\belowcaptionskip}

```

## 7.7 Font changing

Here we supply the declarative font changing commands that were common in  $\text{\LaTeX}$  version 2.09 and earlier. These commands work in text mode *and* in math mode. They are provided for compatibility, but one should start using the `\text...` and `\math...` commands instead. These commands are defined using `\DeclareTextFontCommand`, a command with three arguments: the user command to be defined;  $\text{\LaTeX}$  commands to execute in text mode and  $\text{\LaTeX}$  commands to execute in math mode.

`\rm` The commands to change the family. When in compatibility mode we select the `\tt` ‘default’ font first, to get  $\text{\LaTeX}$  2.09 behaviour.

```

\sf 1127 \DeclareTextFontCommand{\rm}{\normalfont\rmfamily}{\mathrm}
     1128 \DeclareTextFontCommand{\sf}{\normalfont\sfamily}{\mathsf}
     1129 \DeclareTextFontCommand{\tt}{\normalfont\ttfamily}{\mathtt}

```

`\bf` The command to change to the bold series. One should use `\mdseries` to explicitly switch back to medium series.

```

1130 \DeclareTextFontCommand{\bf}{\normalfont\bfseries}{\mathbf}

```

`\sl` And the commands to change the shape of the font. The slanted and small caps `\it` shapes are not available by default as math alphabets, so those changes do nothing `\sc` in math mode. However, we do warn the user that the selection will not have any effect. One should use `\upshape` to explicitly change back to the upright shape.

```

1131 \DeclareTextFontCommand{\it}{\normalfont\itshape}{\mathit}

```

```
1132 \DeclareOldFontCommand{\sl}{\normalfont\slshape}{\@nomath\sl}
1133 \DeclareOldFontCommand{\sc}{\normalfont\scshape}{\@nomath\sc}
```

`\cal` The commands `\cal` and `\mit` should only be used in math mode, outside math mode they have no effect. Currently the New Font Selection Scheme defines these commands to generate warning messages. Therefore we have to define them ‘by hand’.

```
1134 \DeclareRobustCommand*\cal{\@fontswitch\relax\mathcal}
1135 \DeclareRobustCommand*\mit{\@fontswitch\relax\mathnormal}
```

## 8 Cross Referencing

### 8.1 Table of Contents, etc.

A `\section` command writes a `\contentsline{section}{<title>}{<page>}` command on the `.toc` file, where `<title>` contains the contents of the entry and `<page>` is the page number. If sections are being numbered, then `<title>` will be of the form `\numberline{<num>}{<heading>}` where `<num>` is the number produced by `\thesection`. Other sectioning commands work similarly.

A `\caption` command in a ‘figure’ environment writes

`\contentsline{figure}{\numberline{<num>}{<caption>}}{<page>}` on the `.lof` file, where `<num>` is the number produced by `\thefigure` and `<caption>` is the figure caption. It works similarly for a ‘table’ environment.

The command `\contentsline{<name>}` expands to `\l@<name>`. So, to specify the table of contents, we must define `\l@chapter`, `\l@section`, `\l@subsection`, ... ; to specify the list of figures, we must define `\l@figure`; and so on. Most of these can be defined with the `\dottedtocline` command, which works as follows.

`\dottedtocline{<level>}{<indent>}{<numwidth>}{<title>}{<page>}`

`<level>` An entry is produced only if `<level>`  $\leq$  value of the `tocdepth` counter. Note, `\chapter` is level 0, `\section` is level 1, etc.

`<indent>` The indentation from the outer left margin of the start of the contents line.

`<numwidth>` The width of a box in which the section number is to go, if `<title>` includes a `\numberline` command.

`\@pnumwidth` This command uses the following three parameters, which are set with a `\@tocrmarg` `\newcommand` (so em’s can be used to make them depend upon the font).

`\@dotsep` `\@pnumwidth` The width of a box in which the page number is put.

`\@tocrmarg` The right margin for multiple line entries. One wants `\@tocrmarg`  $\geq$  `\@pnumwidth`

`\@dotsep` Separation between dots, in mu units. Should be defined as a number like 2 or 1.7

```
1136 \newcommand\@pnumwidth{1.55em}
```

```
1137 \newcommand\@tocrmarg{2.55em}
```

```
1138 \newcommand\@dotsep{4.5}
```

```
1139 \article\setcounter{tocdepth}{3}
```

```
1140 \!article\setcounter{tocdepth}{2}
```

### 8.1.1 Table of Contents

`\tableofcontents` This macro is used to request that L<sup>A</sup>T<sub>E</sub>X produces a table of contents. In the report and book document classes the tables of contents, figures etc. are always set in single-column mode.

```

1141 \newcommand\tableofcontents{%
1142   <*report | book>
1143   \if@twocolumn
1144     \@restonecoltrue\onecolumn
1145   \else
1146     \@restonecolfalse
1147   \fi

```

The title is set using the `\chapter*` command, making sure that the running head—if one is required—contains the right information.

```

1148   \chapter*{\contentsname
1149 </report | book>
1150 <article>   \section*{\contentsname

```

The code for `\@mkboth` is placed inside the heading to avoid any influence on vertical spacing after the heading (in some cases). For other commands, such as `\listoffigures` below this has been changed from the L<sup>A</sup>T<sub>E</sub>X 2.09 version as it will produce a serious bug if used in two-column mode (see, pr/3285). However `\tableofcontents` is always typeset in one-column mode in these classes, therefore the somewhat inconsistent setting has been retained for compatibility reasons.

```

1151     \@mkboth{%
1152       \MakeUppercase\contentsname}{\MakeUppercase\contentsname}}%

```

The actual table of contents is made by calling `\@starttoc{toc}`. After that we restore two-column mode if necessary.

```

1153   \@starttoc{toc}%
1154 <!article>   \if@restonecol\twocolumn\fi
1155   }

```

`\l@part` Each sectioning command needs an additional macro to format its entry in the table of contents, as described above. The macro for the entry for parts is defined in a special way.

First we make sure that if a pagebreak should occur, it occurs *before* this entry. Also a little whitespace is added and a group begun to keep changes local.

```

1156 \newcommand*\l@part[2]{%
1157   \ifnum \c@tocdepth >-2\relax
1158 <article>   \addpenalty\@secpenalty
1159 <!article>   \addpenalty{-\@highpenalty}%
1160   \addvspace{2.25em \@plus\p}%

```

The macro `\numberline` requires that the width of the box that holds the part number is stored in L<sup>A</sup>T<sub>E</sub>X's scratch register `\@tempdima`. Therefore we initialize it there even though we do not use `\numberline` internally—the value used is quite large so that something like `\numberline{VIII}` would still work.

```

1161   \setlength\@tempdima{3em}%
1162   \begingroup

```

We set `\parindent` to 0pt and use `\rightskip` to leave enough room for the page numbers.<sup>1</sup> To prevent overfull box messages the `\parfillskip` is set to a negative value.

```
1163     \parindent \z@ \rightskip \@pnumwidth
1164     \parfillskip -\@pnumwidth
```

Now we can set the entry, in a large bold font. We make sure to leave vertical mode, set the part title and add the page number, set flush right.

```
1165     {\leavevmode
1166     \large \bfseries #1\hfil
1167     \hb@xt@\@pnumwidth{\hss #2%
1168     \kern-\p@\kern\p@}}\par
```

Prevent a pagebreak immediately after this entry, but use `\everypar` to reset the `\if@nobreak` switch. Finally we close the group.

```
1169     \nobreak
1170 <article>     \if@compatibility
1171             \global\@nobreaktrue
1172             \everypar{\global\@nobreakfalse\everypar{}}%
1173 <article>     \fi
1174     \endgroup
1175 \fi}
```

`\l@chapter` This macro formats the entries in the table of contents for chapters. It is very similar to `\l@part`

First we make sure that if a pagebreak should occur, it occurs *before* this entry. Also a little whitespace is added and a group begun to keep changes local.

```
1176 <*report | book>
1177 \newcommand*\l@chapter[2]{%
1178 \ifnum \c@tocdepth >\m@ne
1179 \addpenalty{-\@highpenalty}%
1180 \vskip 1.0em \@plus\p@
```

The macro `\numberline` requires that the width of the box that holds the part number is stored in L<sup>A</sup>T<sub>E</sub>X's scratch register `\@tempdima`. Therefore we initialize it there even though we do not use `\numberline` internally (the position as well as the values seems questionable but can't be changed without producing compatibility problems). We begin a group, and change some of the paragraph parameters (see also the remark at `\l@part` regarding `\rightskip`).

```
1181 \setlength\@tempdima{1.5em}%
1182 \begingroup
1183 \parindent \z@ \rightskip \@pnumwidth
1184 \parfillskip -\@pnumwidth
```

Then we leave vertical mode and switch to a bold font.

```
1185 \leavevmode \bfseries
```

Because we do not use `\numberline` here, we have to do some fine tuning 'by hand', before we can set the entry. We discourage but not disallow a pagebreak immediately after a chapter entry.

---

<sup>1</sup>We should really set `\rightskip` to `\@tocrmarg` instead of `\@pnumwidth` (no version of L<sup>A</sup>T<sub>E</sub>X ever did this), otherwise the `\rightskip` is too small. Unfortunately this can't be changed in L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> as we don't want to create different versions of L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> which produce different typeset output unless this is absolutely necessary; instead we suspend it for L<sup>A</sup>T<sub>E</sub>X 3.

```

1186     \advance\leftskip\@tempdima
1187     \hskip -\leftskip
1188     #1\nobreak\hfil
1189     \nobreak\hb@xt@\@pnumwidth{\hss #2%
1190                                     \kern-\p@\kern\p@}\par
1191     \penalty\@highpenalty
1192     \endgroup
1193     \fi}
1194 </report | book>

```

`\l@section` In the article document class the entry in the table of contents for sections looks much like the chapter entries for the report and book document classes.

First we make sure that if a pagebreak should occur, it occurs *before* this entry. Also a little whitespace is added and a group begun to keep changes local.

```

1195 <*article>
1196 \newcommand*\l@section[2]{%
1197   \ifnum \c@tocdepth >\z@
1198     \addpenalty\@secpenalty
1199     \addvspace{1.0em \@plus\p@}%

```

The macro `\numberline` requires that the width of the box that holds the part number is stored in L<sup>A</sup>T<sub>E</sub>X's scratch register `\@tempdima`. Therefore we put it there. We begin a group, and change some of the paragraph parameters (see also the remark at `\l@part` regarding `\rightskip`).

```

1200     \setlength\@tempdima{1.5em}%
1201     \begingroup
1202     \parindent \z@ \rightskip \@pnumwidth
1203     \parfillskip -\@pnumwidth

```

Then we leave vertical mode and switch to a bold font.

```

1204     \leavevmode \bfseries

```

Because we do not use `\numberline` here, we have to do some fine tuning ‘by hand’, before we can set the entry. We discourage but not disallow a pagebreak immediately after a chapter entry.

```

1205     \advance\leftskip\@tempdima
1206     \hskip -\leftskip
1207     #1\nobreak\hfil
1208     \nobreak\hb@xt@\@pnumwidth{\hss #2%
1209                                     \kern-\p@\kern\p@}\par
1210     \endgroup
1211     \fi}
1212 </article>

```

In the report and book document classes the definition for `\l@section` is much simpler.

```

1213 <*report | book>
1214 \newcommand*\l@section{\@dottedtocline{1}{1.5em}{2.3em}}
1215 </report | book>

```

`\l@subsection` All lower level entries are defined using the macro `\@dottedtocline` (see above).

```

\l@subsection 1216 <*article>
\l@paragraph 1217 \newcommand*\l@subsection{\@dottedtocline{2}{1.5em}{2.3em}}
\l@subparagraph 1218 \newcommand*\l@subsubsection{\@dottedtocline{3}{3.8em}{3.2em}}

```

```

1219 \newcommand*\l@paragraph{\@dottedtocline{4}{7.0em}{4.1em}}
1220 \newcommand*\l@subparagraph{\@dottedtocline{5}{10em}{5em}}
1221 \end{article}
1222 \end{report} \end{book}
1223 \newcommand*\l@subsection{\@dottedtocline{2}{3.8em}{3.2em}}
1224 \newcommand*\l@subsubsection{\@dottedtocline{3}{7.0em}{4.1em}}
1225 \newcommand*\l@paragraph{\@dottedtocline{4}{10em}{5em}}
1226 \newcommand*\l@subparagraph{\@dottedtocline{5}{12em}{6em}}
1227 \end{report} \end{book}

```

### 8.1.2 List of figures

`\listoffigures` This macro is used to request that L<sup>A</sup>T<sub>E</sub>X produces a list of figures. It is very similar to `\tableofcontents`.

```

1228 \newcommand\listoffigures{%
1229 \end{report} \end{book}
1230 \if@twocolumn
1231 \@restonecoltrue\onecolumn
1232 \else
1233 \@restonecolfalse
1234 \fi
1235 \chapter*{\listfigurename}%
1236 \end{report} \end{book}
1237 \end{article} \section*{\listfigurename}%
1238 \mkboth{\MakeUppercase\listfigurename}%
1239 {\MakeUppercase\listfigurename}%
1240 \@starttoc{lof}%
1241 \end{report} \end{book} \if@restonecol\twocolumn\fi
1242 }

```

`\l@figure` This macro produces an entry in the list of figures.

```

1243 \newcommand*\l@figure{\@dottedtocline{1}{1.5em}{2.3em}}

```

### 8.1.3 List of tables

`\listoftables` This macro is used to request that L<sup>A</sup>T<sub>E</sub>X produces a list of tables. It is very similar to `\tableofcontents`.

```

1244 \newcommand\listoftables{%
1245 \end{report} \end{book}
1246 \if@twocolumn
1247 \@restonecoltrue\onecolumn
1248 \else
1249 \@restonecolfalse
1250 \fi
1251 \chapter*{\listtablename}%
1252 \end{report} \end{book}
1253 \end{article} \section*{\listtablename}%
1254 \mkboth{%
1255 \MakeUppercase\listtablename}%
1256 {\MakeUppercase\listtablename}%
1257 \@starttoc{lot}%
1258 \end{report} \end{book} \if@restonecol\twocolumn\fi
1259 }

```

`\l@table` This macro produces an entry in the list of tables.

```
1260 \let\l@table\l@figure
```

## 8.2 Bibliography

`\bibindent` The “open” bibliography format uses an indentation of `\bibindent`.

```
1261 \newdimen\bibindent
```

```
1262 \setlength\bibindent{1.5em}
```

`thebibliography` (*env.*) The ‘thebibliography’ environment executes the following commands:

```
\renewcommand{\newblock}{\hskip.11em \@plus.33em \@minus.07em}
```

— Defines the “closed” format, where the blocks (major units of information) of an entry run together.

```
\sloppy
```

 — Used because it’s rather hard to do line breaks in bibliographies,

```
\sfcode‘\.=1000\relax
```

 — Causes a ‘.’ (period) not to produce an end-of-sentence space.

The implementation of this environment is based on the generic list environment. It uses the *enumiv* counter internally to generate the labels of the list.

When an empty ‘thebibliography’ environment is found, a warning is issued.

```
1263 \newenvironment{thebibliography}[1]
```

```
1264 <*article>
```

```
1265     {\section*{\refname}}%
```

The `\@mkboth` was moved out of the heading argument since at least in report and book (twocolumn option) there are definitions for `\chapter` which would swallow it otherwise.

```
1266     \@mkboth{\MakeUppercase\refname}{\MakeUppercase\refname}%
```

```
1267 </article>
```

```
1268 <*!article>
```

```
1269     {\chapter*{\bibname}}%
```

```
1270     \@mkboth{\MakeUppercase\bibname}{\MakeUppercase\bibname}%
```

```
1271 </!article>
```

```
1272     \list{\@biblabel{\@arabic\c@enumiv}}%
```

```
1273         {\settowidth\labelwidth{\@biblabel{#1}}%
```

```
1274          \leftmargin\labelwidth
```

```
1275          \advance\leftmargin\labelsep
```

```
1276          \@openbib@code
```

```
1277          \usecounter{enumiv}}%
```

```
1278          \let\p@enumiv\@empty
```

```
1279          \renewcommand\theenumiv{\@arabic\c@enumiv}}%
```

```
1280     \sloppy
```

This is setting the normal (non-infinite) value of `\clubpenalty` for the whole of this environment, so we must reset its stored value also. (Why is there a % after the second 4000 below?)

```
1281     \clubpenalty4000
```

```
1282     \@clubpenalty \clubpenalty
```

```
1283     \widowpenalty4000%
```

```
1284     \sfcode‘\.\@m}
```

```
1285     {\def\@noitemerr
```

```
1286       {\@latex@warning{Empty ‘thebibliography’ environment}}%
```

```
1287     \endlist}
```

`\newblock` The default definition for `\newblock` is to produce a small space.  
1288 `\newcommand\newblock{\hskip .11em\@plus.33em\@minus.07em}`

`\@openbib@code` The default definition for `\@openbib@code` is to do nothing. It will be changed by the `openbib` option.  
1289 `\let\@openbib@code\empty`

`\@biblabel` The label for a `\bibitem[...]` command is produced by this macro. The default from the L<sup>A</sup>T<sub>E</sub>X format is used.  
1290 `% \renewcommand*\@biblabel}[1]{[#1]\hfill}`

`\@cite` The output of the `\cite` command is produced by this macro. The default from the L<sup>A</sup>T<sub>E</sub>X format is used.  
1291 `% \renewcommand*\@cite}[1]{[#1]}`

### 8.3 The index

`theindex` (*env.*) The environment ‘`theindex`’ can be used for indices. It makes an index with two columns, with each entry a separate paragraph. At the user level the commands `\item`, `\subitem` and `\subsubitem` are used to produce index entries of various levels. When a new letter of the alphabet is encountered an amount of `\indexspace` white space can be added.

```

1292 \newenvironment{theindex}
1293     {\if@twocolumn
1294         \@restonecolfalse
1295     \else
1296         \@restonecoltrue
1297     \fi
1298 <article>         \twocolumn[\section*{\indexname}]%
1299 <!article>        \twocolumn[\@makeschapterhead{\indexname}]%
1300                 \@mkboth{\MakeUppercase\indexname}%
1301                 {\MakeUppercase\indexname}%
1302                 \thispagestyle{plain}\parindent\z@

```

Parameter changes to `\columnseprule` and `\columnsep` have to be done after `\twocolumn` has acted. Otherwise they can affect the last page before the index.

```

1303         \parskip\z@ \@plus .3\p@\relax
1304         \columnseprule \z@
1305         \columnsep 35\p@
1306         \let\item\@idxitem

```

When the document continues after the index and it was a one-column document we have to switch back to one column after the index.

```

1307         {\if@restonecol\onecolumn\else\clearpage\fi}

```

`\@idxitem` These macros are used to format the entries in the index.  
`\subitem` 1308 `\newcommand\@idxitem{\par\hangindent 40\p@}`  
`\subsubitem` 1309 `\newcommand\subitem{\@idxitem \hspace*{20\p@}}`  
1310 `\newcommand\subsubitem{\@idxitem \hspace*{30\p@}}`

`\indexspace` The amount of white space that is inserted between ‘letter blocks’ in the index.  
1311 `\newcommand\indexspace{\par \vskip 10\p@ \@plus5\p@ \@minus3\p@\relax}`

## 8.4 Footnotes

`\footnoterule` Usually, footnotes are separated from the main body of the text by a small rule. This rule is drawn by the macro `\footnoterule`. We have to make sure that the rule takes no vertical space (see `plain.tex`) so we compensate for the natural height of the rule of 0.4pt by adding the right amount of vertical skip.

To prevent the rule from colliding with the footnote we first add a little negative vertical skip, then we put the rule and make sure we end up at the same point where we began this operation.

```
1312 \renewcommand\footnoterule{%
1313   \kern-3\p@
1314   \hrule\@width.4\columnwidth
1315   \kern2.6\p@}
```

`\c@footnote` Footnotes are numbered within chapters in the report and book document classes.

```
1316 \!article\@addtoreset{footnote}{chapter}
```

`\@makefnmark` The footnote mechanism of L<sup>A</sup>T<sub>E</sub>X calls the macro `\@makefnmark` to produce the actual footnote. The macro gets the text of the footnote as its argument and should use `\@thefnmark` as the mark of the footnote. The macro `\@makefnmark` is called when effectively inside a `\parbox` of width `\columnwidth` (i.e., with `\hsize = \columnwidth`).

An example of what can be achieved is given by the following piece of T<sub>E</sub>X code.

```
\newcommand\@makefnmark[1]{%
  \setpar{\@par
    \@tempdima = \hsize
    \advance\@tempdima-10pt
    \parshape \@ne 10pt \@tempdima}%
  \par
  \parindent 1em\noindent
  \hbox to \z@\hss\@makefnmark#1}
```

The effect of this definition is that all lines of the footnote are indented by 10pt, while the first line of a new paragraph is indented by 1em. To change these dimensions, just substitute the desired value for ‘10pt’ (in both places) or ‘1em’. The mark is flushright against the footnote.

In these document classes we use a simpler macro, in which the footnote text is set like an ordinary text paragraph, with no indentation except on the first line of a paragraph, and the first line of the footnote. Thus, all the macro must do is set `\parindent` to the appropriate value for succeeding paragraphs and put the proper indentation before the mark.

```
1317 \newcommand\@makefnmark[1]{%
1318   \parindent 1em%
1319   \noindent
1320   \hb@xt@1.8em{\hss\@makefnmark#1}
```

`\@makefnmark` The footnote markers that are printed in the text to point to the footnotes should be produced by the macro `\@makefnmark`. We use the default definition for it.

```
1321 %\renewcommand\@makefnmark{\hbox{\@textsuperscript
1322 %\normalfont\@thefnmark}}
```

## 9 Initialization

### 9.1 Words

This document class is for documents prepared in the English language. To prepare a version for another language, various English words must be replaced. All the English words that require replacement are defined below in command names. These commands may be redefined in any class or package that is customising L<sup>A</sup>T<sub>E</sub>X for use with non-English languages.

```
\contentsname
\listfigurename 1323 \newcommand\contentsname{Contents}
\listtablename 1324 \newcommand\listfigurename{List of Figures}
                  1325 \newcommand\listtablename{List of Tables}

\refname
\bibname 1326 <article>\newcommand\refname{References}
\indexname 1327 <report | book>\newcommand\bibname{Bibliography}
            1328 \newcommand\indexname{Index}

\figurename
\tablename 1329 \newcommand\figurename{Figure}
            1330 \newcommand\tablename{Table}

\partname
\chaptername 1331 \newcommand\partname{Part}
\appendixname 1332 <report | book>\newcommand\chaptername{Chapter}
\abstractname 1333 \newcommand\appendixname{Appendix}
            1334 <!book>\newcommand\abstractname{Abstract}
```

### 9.2 Date

`\today` This macro uses the T<sub>E</sub>X primitives `\month`, `\day` and `\year` to provide the date of the L<sup>A</sup>T<sub>E</sub>X-run.

At `\begin{document}` this definition will be optimised so that the names of all the ‘wrong’ months are not stored. This optimisation is not done here as that would ‘freeze’ `\today` in any special purpose format made by loading the class file into the format file.

```
1335 \def\today{\ifcase\month\or
1336   January\or February\or March\or April\or May\or June\or
1337   July\or August\or September\or October\or November\or December\fi
1338   \space\number\day, \number\year}
```

### 9.3 Two-column mode

`\columnsep` This gives the distance between two columns in two-column mode.

```
1339 \setlength\columnsep{10\p@}
```

`\columnseprule` This gives the width of the rule between two columns in two-column mode. We have no visible rule.

```
1340 \setlength\columnseprule{0\p@}
```

## 9.4 The page style

We have *plain* pages in the document classes `article` and `report` unless the user specified otherwise. In the ‘book’ document class we use the page style *headings* by default. We use arabic page numbers.

```
1341 \!book\pagestyle{plain}
1342 \book\pagestyle{headings}
1343 \pagenumbering{arabic}
```

## 9.5 Single or double sided printing

When the `twoside` option wasn’t specified, we don’t try to make each page as long as all the others.

```
1344 \if@twoside
1345 \else
1346 \raggedbottom
1347 \fi
```

When the `twocolumn` option was specified we call `\twocolumn` to activate this mode. We try to make each column as long as the others, but call `sloppy` to make our life easier.

```
1348 \if@twocolumn
1349 \twocolumn
1350 \sloppy
1351 \flushbottom
```

Normally we call `\onecolumn` to initiate typesetting in one column.

```
1352 \else
1353 \onecolumn
1354 \fi
1355 </article | report | book>
```

## Index

Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in *roman* refer to the code lines where the entry is used.

<b>Symbols</b>	<code>\@chapter</code> . . . . . <a href="#">789, 790</a>	<a href="#">1225, 1226, 1243</a>
<code>\@Roman</code> . . . . . <a href="#">651</a>	<code>\@cite</code> . . . . . <a href="#">1291</a>	<code>\@endparpenalty</code> <a href="#">885, 977</a>
<code>\@afterheading</code> . . . . . . <a href="#">731, 761, 811, 831</a>	<code>\@clubpenalty</code> . . . . . <a href="#">1282</a>	<code>\@endpart</code> . <a href="#">751, 769, 771</a>
<code>\@afterindentfalse</code> . . . . . . . . . . <a href="#">692, 788</a>	<code>\@date</code> . . . . . <a href="#">545,</a> <a href="#">563, 573, 607, 628</a>	<code>\@eqnnum</code> . . . . . <a href="#">1074</a>
<code>\@author</code> . . . . . <a href="#">544,</a> <a href="#">560, 572, 606, 625</a>	<code>\@dblfloat</code> . . . . . <a href="#">1092, 1111</a>	<code>\@evenfoot</code> <a href="#">474, 476, 535</a>
<code>\@beginparpenalty</code> . . . . . . . . . . <a href="#">885, 974</a>	<code>\@dblfpbot</code> . . . . . <a href="#">458</a>	<code>\@evenhead</code> <a href="#">474, 477, 536</a>
<code>\@biblabel</code> . . . . . . . . . . <a href="#">1272, 1273, 1290</a>	<code>\@dblfpsep</code> . . . . . <a href="#">458</a>	<code>\@fnsymbol</code> . . . . . <a href="#">583</a>
<code>\@chapapp</code> . . . . . <a href="#">499, 528,</a> <a href="#">661, 793, 818, 1056</a>	<code>\@dblftop</code> . . . . . <a href="#">458</a>	<code>\@fontswitch</code> <a href="#">1134, 1135</a>
	<code>\@dotsep</code> . . . . . <a href="#">1136</a>	<code>\@fpbot</code> . . . . . <a href="#">443</a>
	<code>\@dottedtocline</code> <a href="#">1214,</a> <a href="#">1217, 1218,</a> <a href="#">1219, 1220,</a> <a href="#">1223, 1224,</a>	<code>\@fpsep</code> . . . . . <a href="#">443</a>
		<code>\@fptop</code> . . . . . <a href="#">443</a>
		<code>\@highpenalty</code> . <a href="#">227,</a> <a href="#">1159, 1179, 1191</a>
		<code>\@idxtitem</code> . . . . . <a href="#">1306, 1308</a>

<code>\@itempenalty</code> . . . . .	<a href="#">885</a>	<a href="#">1035</a> , <a href="#">1146</a> ,	<code>\abovedisplayskip</code> .
<code>\@latex@warning</code> ..	<a href="#">1286</a>	<a href="#">1233</a> , <a href="#">1249</a> , <a href="#">1294</a>	..... <a href="#">91</a> , <a href="#">97</a> ,
<code>\@listI</code> . . . . .	<a href="#">108</a> , <a href="#">890</a>		<a href="#">103</a> , <a href="#">107</a> , <a href="#">116</a> ,
<code>\@listi</code> . . . . .	<a href="#">108</a> ,	<code>\@restonecoltrue</code> ..	<a href="#">126</a> , <a href="#">136</a> , <a href="#">144</a> ,
<a href="#">119</a> , <a href="#">129</a> , <a href="#">139</a> ,		..... <a href="#">1019</a> ,	<a href="#">149</a> , <a href="#">159</a> , <a href="#">169</a> , <a href="#">177</a>
<a href="#">152</a> , <a href="#">162</a> , <a href="#">172</a> , <a href="#">890</a>		<a href="#">1033</a> , <a href="#">1144</a> ,	<code>abstract (env.)</code> . . . . .
<code>\@listii</code> . . . . .	<a href="#">909</a>	<a href="#">1231</a> , <a href="#">1247</a> , <a href="#">1296</a>	<a href="#">967</a>
<code>\@listiii</code> . . . . .	<a href="#">909</a>	<code>\@roman</code> . . . . .	<code>\abstractname</code> . . . . .
<code>\@listiv</code> . . . . .	<a href="#">909</a>	..... <a href="#">947</a>	<a href="#">976</a> , <a href="#">983</a> , <a href="#">987</a> , <a href="#">1331</a>
<code>\@listv</code> . . . . .	<a href="#">909</a>	<code>\@schapter</code> ...	<code>\addcontentsline</code> ..
<code>\@listvi</code> . . . . .	<a href="#">909</a>	<a href="#">789</a> , <a href="#">827</a>	. <a href="#">716</a> , <a href="#">718</a> , <a href="#">737</a> ,
<code>\@lowpenalty</code> ..	<a href="#">227</a> ,	<code>\@secpenalty</code> <a href="#">1158</a> , <a href="#">1198</a>	<a href="#">739</a> , <a href="#">794</a> , <a href="#">798</a> , <a href="#">802</a>
<a href="#">886</a> , <a href="#">887</a> , <a href="#">888</a> , <a href="#">974</a>		<code>\@setfontsize</code> . . . . .	<code>\addtocontents</code> <a href="#">805</a> , <a href="#">806</a>
<code>\@mainmatterfalse</code> .		<a href="#">90</a> , <a href="#">96</a> , <a href="#">102</a> , <a href="#">115</a> ,	<code>\and</code> . . . . .
..... <a href="#">669</a> , <a href="#">685</a>		<a href="#">125</a> , <a href="#">135</a> , <a href="#">148</a> ,	<a href="#">578</a> , <a href="#">612</a>
<code>\@mainmattertrue</code> <a href="#">8</a> , <a href="#">677</a>		<a href="#">158</a> , <a href="#">168</a> , <a href="#">181</a> ,	<code>\appendix</code> . . . . .
<code>\@makecaption</code> . . . . .	<a href="#">1113</a>	<a href="#">182</a> , <a href="#">183</a> , <a href="#">184</a> ,	<a href="#">1046</a>
<code>\@makechapterhead</code> .		<a href="#">185</a> , <a href="#">186</a> , <a href="#">187</a> ,	<code>\appendixname</code> <a href="#">1056</a> , <a href="#">1331</a>
..... <a href="#">808</a> , <a href="#">810</a> , <a href="#">813</a>		<a href="#">190</a> , <a href="#">191</a> , <a href="#">192</a> ,	<code>\arraycolsep</code> . . . . .
<code>\@makefnmark</code> . . . . .		<a href="#">193</a> , <a href="#">194</a> , <a href="#">195</a> ,	<a href="#">1059</a>
.. <a href="#">584</a> , <a href="#">1320</a> , <a href="#">1321</a>		<a href="#">196</a> , <a href="#">199</a> , <a href="#">200</a> ,	<code>\arrayrulewidth</code> ..
<code>\@makefntext</code> . <a href="#">585</a> , <a href="#">1317</a>		<a href="#">201</a> , <a href="#">202</a> , <a href="#">203</a> , <a href="#">204</a>	<a href="#">1061</a>
<code>\@makeschapterhead</code> .		<code>\@settopoint</code> ..	<code>\AtEndOfPackage</code> ...
<a href="#">828</a> , <a href="#">830</a> , <a href="#">833</a> , <a href="#">1299</a>		<a href="#">286</a> ,	<a href="#">65</a>
<code>\@maketitle</code> ...	<a href="#">590</a> ,	<a href="#">374</a> , <a href="#">375</a> , <a href="#">380</a> , <a href="#">395</a>	<code>\author</code> ...
<a href="#">592</a> , <a href="#">597</a> , <a href="#">604</a> , <a href="#">614</a>		<code>\@spart</code> ...	<a href="#">543</a> , <a href="#">576</a> , <a href="#">610</a>
<code>\@medpenalty</code> . . . . .	<a href="#">227</a>	<a href="#">693</a> , <a href="#">710</a> , <a href="#">753</a>	
<code>\@minipagefalse</code> ..	<a href="#">1123</a>	<code>\@startsection</code> <a href="#">842</a> ,	<b>B</b>
<code>\@minipagerestore</code> <a href="#">1064</a>		<a href="#">846</a> , <a href="#">850</a> , <a href="#">854</a> , <a href="#">858</a>	<code>\backmatter</code> . . . . .
<code>\@mparswitchfalse</code> .	<a href="#">41</a>	<code>\@starttoc</code> . . . . .	..... <a href="#">289</a> , <a href="#">290</a> ,
<code>\@mparswitchtrue</code> ..	<a href="#">43</a>	.....	<a href="#">291</a> , <a href="#">292</a> , <a href="#">297</a> , <a href="#">299</a>
<code>\@mpfootins</code> . . . . .	<a href="#">1064</a>	.. <a href="#">1153</a> , <a href="#">1240</a> , <a href="#">1257</a>	<code>\baselinestretch</code> ..
<code>\@nobreakfalse</code> ...	<a href="#">1172</a>	<code>\@starttoc</code> . . . . .	<a href="#">210</a>
<code>\@nobreaktrue</code> . . . . .	<a href="#">1171</a>	.....	<code>\belowcaptionskip</code> .
<code>\@noitemerr</code> . . . . .	<a href="#">1285</a>	<code>\@textsuperscript</code> .	.....
<code>\@normalsize</code> . . . . .	<a href="#">87</a>	.. <a href="#">584</a> , <a href="#">587</a> , <a href="#">1321</a>	<a href="#">1113</a> , <a href="#">1126</a>
<code>\@oddfnfoot</code> . . . . .		<code>\@thanks</code> . . . . .	<code>\belowdisplayshortskip</code>
.. <a href="#">474</a> , <a href="#">476</a> , <a href="#">512</a> , <a href="#">535</a>		.. <a href="#">565</a> , <a href="#">571</a> , <a href="#">599</a> , <a href="#">605</a>	.....
<code>\@oddfnhead</code> . . . . .		<code>\@thefnmark</code> . . . . .	<a href="#">93</a> , <a href="#">99</a> ,
.. <a href="#">474</a> , <a href="#">478</a> , <a href="#">513</a> , <a href="#">537</a>		.. <a href="#">584</a> , <a href="#">587</a> , <a href="#">1322</a>	<a href="#">105</a> , <a href="#">118</a> , <a href="#">128</a> ,
<code>\@openbib@code</code> . . . . .		<code>\@title</code> . . . . .	<a href="#">138</a> , <a href="#">151</a> , <a href="#">161</a> , <a href="#">171</a>
.. <a href="#">66</a> , <a href="#">1276</a> , <a href="#">1289</a>		..... <a href="#">543</a> ,	<code>\belowdisplayskip</code> .
<code>\@openrightfalse</code> ..	<a href="#">56</a>	<a href="#">555</a> , <a href="#">574</a> , <a href="#">608</a> , <a href="#">620</a>	.....
<code>\@openrighttrue</code> .	<a href="#">53</a> , <a href="#">55</a>	<code>\@titlepagefalse</code> .	<a href="#">107</a> , <a href="#">144</a> , <a href="#">177</a>
<code>\@part</code> . . . . .	<a href="#">693</a> , <a href="#">710</a> , <a href="#">712</a>	.. <a href="#">5</a> , <a href="#">50</a>	<code>\bf</code> . . . . .
<code>\@pnumwidth</code> ...	<a href="#">1136</a> ,	<code>\@titlepagetrue</code> ..	<a href="#">1130</a>
<a href="#">1163</a> , <a href="#">1164</a> ,		.. <a href="#">6</a> , <a href="#">48</a>	<code>\bibindent</code> <a href="#">67</a> , <a href="#">68</a> , <a href="#">1261</a>
<a href="#">1167</a> , <a href="#">1183</a> ,		<code>\@tocrmarg</code> . . . . .	<code>\bibname</code> <a href="#">1269</a> , <a href="#">1270</a> , <a href="#">1326</a>
<a href="#">1184</a> , <a href="#">1189</a> ,		..... <a href="#">1136</a>	<code>\bigskipamount</code> . . . . .
<a href="#">1202</a> , <a href="#">1203</a> , <a href="#">1208</a>		<code>\@topnewpage</code> ..	<a href="#">222</a>
<code>\@ptsize</code> . . . . .	<a href="#">1</a> , <a href="#">34</a> ,	<code>\@topnum</code> . . . . .	<code>\bottomfraction</code> ...
<a href="#">36</a> , <a href="#">38</a> , <a href="#">39</a> , <a href="#">84</a> , <a href="#">85</a>		..... <a href="#">596</a> , <a href="#">787</a>	<a href="#">408</a>
<code>\@restonecolfalse</code> .		<code>\@twocolumnfalse</code> ..	<code>\brokenpenalty</code> . . . . .
..... <a href="#">1021</a> ,		.. <a href="#">59</a>	<a href="#">237</a>
		<code>\@twocolumntrue</code> ...	
		.. <a href="#">61</a>	
		<code>\@twosidefalse</code> . . . . .	
		..... <a href="#">41</a>	
		<code>\@twosidetrue</code> . . . . .	
		..... <a href="#">43</a>	
		<code>\@undefined</code> . . . . .	
		..... <a href="#">110</a>	
		<code>\@width</code> . . . . .	
		..... <a href="#">1314</a>	
		<b>A</b>	
		<code>\abovcaptionskip</code> .	
		..... <a href="#">1113</a> , <a href="#">1118</a>	
		<code>\abovedisplayshortskip</code>	
		..... <a href="#">92</a> , <a href="#">98</a> ,	
		<a href="#">104</a> , <a href="#">117</a> , <a href="#">127</a> ,	
		<a href="#">137</a> , <a href="#">150</a> , <a href="#">160</a> , <a href="#">170</a>	
			<code>\c@bottomnumber</code> ...
			<a href="#">407</a>
			<code>\c@chapter</code> . . . . .
			.....
			<a href="#">641</a> , <a href="#">654</a> , <a href="#">1057</a> ,
			<a href="#">1071</a> , <a href="#">1082</a> , <a href="#">1101</a>
			<code>\c@dbltopnumber</code> ...
			<a href="#">412</a>
			<code>\c@enumi</code> . . . . .
			..... <a href="#">945</a>
			<code>\c@enumii</code> . . . . .
			..... <a href="#">946</a>
			<code>\c@enumiii</code> . . . . .
			..... <a href="#">947</a>
			<code>\c@enumiv</code> <a href="#">948</a> , <a href="#">1272</a> , <a href="#">1279</a>
			<code>\cequation</code> . <a href="#">1067</a> , <a href="#">1071</a>
			<code>\c@figure</code> . . . . .
			<a href="#">1075</a>
			<code>\c@footnote</code> ..
			<a href="#">583</a> , <a href="#">1316</a>





<code>\partname</code> . . . . .	<a href="#">724</a> , <a href="#">746</a> , <a href="#">1331</a>	<code>\subsubsection</code> . . . . .	<a href="#">850</a>	<code>\theparagraph</code> . . . . .	<a href="#">651</a>
<code>\partopsep</code> . . . . .	<a href="#">881</a> , <a href="#">932</a>	<code>\subsubsectionmark</code> . . . . .	<a href="#">633</a>	<code>\thepart</code> . . . . .	<a href="#">651</a> , <a href="#">716</a> , <a href="#">724</a> , <a href="#">737</a> , <a href="#">746</a>
<code>\postdisplaypenalty</code> . . . . .	<a href="#">233</a>	<b>T</b>			
<code>\predisplaypenalty</code> . . . . .	<a href="#">233</a>	<code>\tabbingsep</code> . . . . .	<a href="#">1063</a>	<code>\thesection</code> . . . . .	<a href="#">484</a> , <a href="#">506</a> , <a href="#">519</a> , <a href="#">651</a> , <a href="#">1050</a>
<code>\ps@headings</code> . . . . .	<a href="#">474</a>	<code>\tabcolsep</code> . . . . .	<a href="#">1060</a>	<code>\thesubparagraph</code> . . . . .	<a href="#">651</a>
<code>\ps@myheadings</code> . . . . .	<a href="#">534</a>	<code>table</code> (env.) . . . . .	<a href="#">1107</a>	<code>\thesubsection</code> . . . . .	<a href="#">490</a> , <a href="#">651</a>
<b>Q</b>					
<code>\quad</code> . . . . .	<a href="#">484</a> , <a href="#">490</a> , <a href="#">519</a>	<code>table*</code> (env.) . . . . .	<a href="#">1107</a>	<code>\thesubsubsection</code> . . . . .	<a href="#">651</a>
<code>\quotation</code> . . . . .	<a href="#">989</a>	<code>tablename</code> . . . . .	<a href="#">1106</a> , <a href="#">1329</a>	<code>\thetable</code> . . . . .	<a href="#">1096</a> , <a href="#">1100</a> , <a href="#">1106</a>
<code>quotation</code> (env.) . . . . .	<a href="#">1003</a>	<code>tableofcontents</code> . . . . .	<a href="#">1141</a>	<code>\thispagestyle</code> . . . . .	<a href="#">599</a> , <a href="#">702</a> , <a href="#">776</a> , <a href="#">786</a> , <a href="#">1023</a> , <a href="#">1037</a> , <a href="#">1302</a>
<code>quote</code> (env.) . . . . .	<a href="#">1010</a>	<code>\textasteriskcentered</code> . . . . .	<a href="#">958</a>	<code>\tiny</code> . . . . .	<a href="#">180</a>
<b>R</b>					
<code>\refname</code> . . . . .	<a href="#">1265</a> , <a href="#">1266</a> , <a href="#">1326</a>	<code>\textbullet</code> . . . . .	<a href="#">956</a>	<code>\title</code> . . . . .	<a href="#">543</a> , <a href="#">575</a> , <a href="#">609</a>
<code>\rm</code> . . . . .	<a href="#">1127</a>	<code>\textendash</code> . . . . .	<a href="#">957</a>	<code>\titlepage</code> . . . . .	<a href="#">972</a>
<b>S</b>					
<code>\sbox</code> . . . . .	<a href="#">1119</a>	<code>\textfloatsep</code> . . . . .	<a href="#">416</a>	<code>\titlepage</code> (env.) . . . . .	<a href="#">1014</a>
<code>\sc</code> . . . . .	<a href="#">1131</a>	<code>\textfraction</code> . . . . .	<a href="#">410</a>	<code>\today</code> . . . . .	<a href="#">546</a> , <a href="#">1335</a>
<code>\scriptsize</code> . . . . .	<a href="#">180</a>	<code>\textheight</code> . . . . .	<a href="#">288</a> , <a href="#">392</a>	<code>\topfraction</code> . . . . .	<a href="#">406</a>
<code>\scshape</code> . . . . .	<a href="#">1133</a>	<code>\textperiodcentered</code> . . . . .	<a href="#">959</a>	<code>\topmargin</code> . . . . .	<a href="#">382</a>
<code>\section</code> . . . . .	<a href="#">842</a> , <a href="#">983</a> , <a href="#">1150</a> , <a href="#">1237</a> , <a href="#">1253</a> , <a href="#">1265</a> , <a href="#">1298</a>	<code>\textwidth</code> . . . . .	<a href="#">254</a> , <a href="#">355</a> , <a href="#">363</a> , <a href="#">378</a>	<code>\topsep</code> . . . . .	<a href="#">120</a> , <a href="#">130</a> , <a href="#">140</a> , <a href="#">153</a> , <a href="#">163</a> , <a href="#">173</a> , <a href="#">894</a> , <a href="#">899</a> , <a href="#">904</a> , <a href="#">913</a> , <a href="#">917</a> , <a href="#">921</a> , <a href="#">928</a> , <a href="#">929</a> , <a href="#">930</a> , <a href="#">933</a>
<code>\sectionmark</code> . . . . .	<a href="#">481</a> , <a href="#">503</a> , <a href="#">516</a> , <a href="#">540</a> , <a href="#">633</a>	<code>\thanks</code> . . . . .	<a href="#">551</a> , <a href="#">569</a> , <a href="#">602</a> , <a href="#">619</a>	<code>\topskip</code> . . . . .	<a href="#">239</a> , <a href="#">253</a> , <a href="#">301</a>
<code>\sf</code> . . . . .	<a href="#">1127</a>	<code>thebibliography</code> . . . . .	<a href="#">1263</a>	<code>\tt</code> . . . . .	<a href="#">1127</a>
<code>\sffamily</code> . . . . .	<a href="#">1128</a>	<code>(env.)</code> . . . . .	<a href="#">1263</a>	<code>\ttfamily</code> . . . . .	<a href="#">1129</a>
<code>\sl</code> . . . . .	<a href="#">1131</a>	<code>\thechapter</code> . . . . .	<a href="#">499</a> , <a href="#">528</a> , <a href="#">651</a> , <a href="#">793</a> , <a href="#">795</a> , <a href="#">818</a> , <a href="#">1057</a> , <a href="#">1071</a> , <a href="#">1082</a> , <a href="#">1101</a>	<code>\twocolumn</code> . . . . .	<a href="#">592</a> , <a href="#">781</a> , <a href="#">1026</a> , <a href="#">1040</a> , <a href="#">1154</a> , <a href="#">1241</a> , <a href="#">1258</a> , <a href="#">1298</a> , <a href="#">1299</a> , <a href="#">1349</a>
<code>\small</code> . . . . .	<a href="#">113</a> , <a href="#">549</a> , <a href="#">985</a>	<code>\theenumi</code> . . . . .	<a href="#">944</a> , <a href="#">949</a> , <a href="#">953</a> , <a href="#">954</a>	<b>V</b>	
<code>\smallskipamount</code> . . . . .	<a href="#">222</a>	<code>\theenumii</code> . . . . .	<a href="#">944</a> , <a href="#">950</a> , <a href="#">954</a>	<code>verse</code> (env.) . . . . .	<a href="#">994</a>
<code>\subitem</code> . . . . .	<a href="#">1308</a>	<code>\theenumiii</code> . . . . .	<a href="#">944</a> , <a href="#">951</a> , <a href="#">955</a>	<b>W</b>	
<code>\subparagraph</code> . . . . .	<a href="#">858</a>	<code>\theenumiv</code> . . . . .	<a href="#">944</a> , <a href="#">952</a> , <a href="#">1279</a>	<code>\widowpenalty</code> . . . . .	<a href="#">231</a> , <a href="#">1283</a>
<code>\subparagraphmark</code> . . . . .	<a href="#">633</a>	<code>\theequation</code> . . . . .	<a href="#">1067</a> , <a href="#">1074</a>		
<code>\subsection</code> . . . . .	<a href="#">846</a>	<code>\thefigure</code> . . . . .	<a href="#">1077</a> , <a href="#">1081</a> , <a href="#">1087</a>		
<code>\subsectionmark</code> . . . . .	<a href="#">487</a> , <a href="#">541</a> , <a href="#">633</a>	<code>\thefootnote</code> . . . . .	<a href="#">583</a>		
<code>\subsubitem</code> . . . . .	<a href="#">1308</a>	<code>theindex</code> (env.) . . . . .	<a href="#">1292</a>		
		<code>\thepage</code> . . . . .	<a href="#">477</a> , <a href="#">478</a> , <a href="#">513</a> , <a href="#">536</a> , <a href="#">537</a>		