\textsc{\LaTeX 2\varepsilon} font selection

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Contents

1 Introduction \hspace{1cm} 2
\hspace{0.5cm} 1.1 \LaTeX 2\varepsilon fonts \hspace{0.5cm} 2
\hspace{0.5cm} 1.2 Overview \hspace{0.5cm} 2
\hspace{0.5cm} 1.3 Further information \hspace{0.5cm} 3

2 Text fonts \hspace{1cm} 4
\hspace{0.5cm} 2.1 Text font attributes \hspace{0.5cm} 4
\hspace{0.5cm} 2.2 Selection commands \hspace{0.5cm} 6
\hspace{0.5cm} 2.3 Internals \hspace{0.5cm} 7
\hspace{0.5cm} 2.4 Parameters for author commands \hspace{0.5cm} 8
\hspace{0.5cm} 2.5 Special font declaration commands \hspace{0.5cm} 9

3 Math fonts \hspace{1cm} 10
\hspace{0.5cm} 3.1 Math font attributes \hspace{0.5cm} 11
\hspace{0.5cm} 3.2 Selection commands \hspace{0.5cm} 12
\hspace{0.5cm} 3.3 Declaring math versions \hspace{0.5cm} 13
\hspace{0.5cm} 3.4 Declaring math alphabets \hspace{0.5cm} 13
\hspace{0.5cm} 3.5 Declaring symbol fonts \hspace{0.5cm} 14
\hspace{0.5cm} 3.6 Declaring math symbols \hspace{0.5cm} 15
\hspace{0.5cm} 3.7 Declaring math sizes \hspace{0.5cm} 16

4 Font installation \hspace{1cm} 17
\hspace{0.5cm} 4.1 Font definition files \hspace{0.5cm} 17
\hspace{0.5cm} 4.2 Font definition file commands \hspace{0.5cm} 17
\hspace{0.5cm} 4.3 Font file loading information \hspace{0.5cm} 19
\hspace{0.5cm} 4.4 Size functions \hspace{0.5cm} 20
1 Introduction

This document describes the new font selection features of the \LaTeX{} Document Preparation System. It is intended for package writers who want to write font-loading packages similar to \texttt{times} or \texttt{latexsym}.

This document is only a brief introduction to the new facilities and is intended for package writers who are familiar with \TeX{} fonts and \LaTeX{} packages. It is \textit{neither} a user-guide \textit{nor} a reference manual for fonts in \LaTeX{} 2ε.

1.1 \LaTeX{} 2ε fonts

The most important difference between \LaTeX{} 2.09 and \LaTeX{} 2ε is the way that fonts are selected. In \LaTeX{} 2.09, the Computer Modern fonts were built into the \LaTeX{} format, and so customizing \LaTeX{} to use other fonts was a major effort.

In \LaTeX{} 2ε, very few fonts are built into the format, and there are commands to load new text and math fonts. Packages such as \texttt{times} or \texttt{latexsym} allow authors to access these fonts. This document describes how to write similar font-loading packages.

The \LaTeX{} 2ε font selection system was first released as the ’New Font Selection Scheme’ (NFSS) in 1989, and then in release 2 in 1993. \LaTeX{} 2ε includes NFSS release 2 as standard.

1.2 Overview

This document contains an overview of the new font commands of \LaTeX{}. 
Section 2 describes the commands for selecting fonts in classes and packages. It lists the five \LaTeX{} font attributes, and lists the commands for selecting fonts. It also describes how to customize the author commands such as \texttt{\textit} and \texttt{\textsc} to suit your document design.

Section 3 explains the commands for controlling \LaTeX{} math fonts. It describes how to specify new math fonts and new math symbols.

Section 4 explains how to install new fonts into \LaTeX{}. It shows how \LaTeX{} font attributes are turned into \TeX{} font names, and how to specify your own fonts using font definition files.

Section 5 discusses text font encodings. It describes how to declare a new encoding and how to define commands, such as \texttt{\textae} or \texttt{\textasciitilde}, which have different definitions in different encodings, depending on whether ligatures, etc. are available in the encoding.

Section 6 covers font miscellanea. It describes how \LaTeX{} performs font substitution, how to customize fonts that are preloaded in the \LaTeX{} format, and the naming conventions used in \LaTeX{} font selection.

1.3 Further information

For a general introduction to \LaTeX{}, including the new features of \LaTeX{} 2e, you should read \LaTeX{}: A Document Preparation System, Leslie Lamport, Addison Wesley, 2nd ed., 1994.

A more detailed description of the \LaTeX{} font selection scheme is to be found in The \LaTeX{} Companion, Goossens, Mittelbach and Samarin, Addison Wesley, 1994.

The \LaTeX{} font selection scheme is based on \TeX{}, which is described by its developer in The \TeX{}book, Donald E. Knuth, Addison Wesley, 1986, revised in 1991 to include the features of \TeX{} 3.

Sebastian Rahtz’s \texttt{psnfss} software contains the software for using a large number of Type 1 fonts (including the Adobe Laser Writer 35 and the Monotype CD-ROM fonts) in \LaTeX{}. It should be available from the same source as your copy of \LaTeX{}.

The \texttt{psnfss} software uses fonts generated by Alan Jeffrey’s \texttt{fontinst} software. This can convert fonts from Adobe Font Metric format into a format readable by \LaTeX{}, including the generation of the .fd files described in Section 4. The \texttt{fontinst} software should be available from the same source as your copy of \LaTeX{}.

Whenever practical, \LaTeX{} uses the font naming scheme described in Filenames for fonts, Karl Berry, \textit{TUGboat} 11(4), 1990.
The class-writer’s guide \textit{B\TeX\ 2e for Class and Package Writers} describes the new \LaTeX\ features for writers of document classes and packages and is kept in clsguide.tex. Configuring \LaTeX\ is covered by the guide \textit{Configuration options for B\TeX\ 2e} in cfgguide.tex whilst the philosophy behind our policy on modifying \LaTeX\ is described in \textit{Modifying \LaTeX\ in modguide.tex}.

We are gradually turning the source code for \LaTeX\ into a \LaTeX\ document \textit{B\TeX: the program}. This document includes an index of \LaTeX\ commands and can be typeset from source2e.tex.

For more information about \TeX\ and \LaTeX, please contact your local \TeX\ Users Group, or the international \TeX\ Users Group. Here are some useful addresses.

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Fax: +1 415 982 8559 Email: tug@tug.org  
UK TUG, 1 Eymore Close, Selly Oak, Birmingham B29 4LB, UK  
Fax: +44 121 476 2159 Email: uk tug-enquiries@tex.ac.uk

\section{Text fonts}

This section describes the commands available to class and package writers for specifying and selecting fonts.

\subsection{Text font attributes}

Every text font in \LaTeX\ has five \textit{attributes}:

\begin{itemize}
  \item \textbf{encoding} This specifies the order that characters appear in the font. The two most common text encodings used in \LaTeX\ are Knuth’s ‘\TeX\ text’ encoding, and the ‘\TeX\ text extended’ encoding developed by the \TeX\ Users Group members during a \TeX\ Conference at Cork in 1990 (hence its informal name ‘Cork encoding’).
  \item \textbf{family} The name for a collection of fonts, usually grouped under a common name by the font foundry. For example, ‘Adobe Times’, ‘ITC Garamond’, and Knuth’s ‘Computer Modern Roman’ are all font families.
  \item \textbf{series} How heavy or expanded a font is. For example, ‘medium weight’, ‘narrow’ and ‘bold extended’ are all series.
  \item \textbf{shape} The form of the letters within a font family. For example, ‘italic’, ‘oblique’ and ‘upright’ (sometimes called ‘roman’) are all font shapes.
  \item \textbf{size} The design size of the font, for example ‘10pt’.
\end{itemize}
The possible values for these attributes are given short acronyms by \LaTeX{}. The most common values for the font encoding are:

- OT1 \TeX{} text
- T1 \TeX{} extended text
- OML \TeX{} math italic
- OMS \TeX{} math symbols
- OMX \TeX{} math large symbols
- U Unknown
- L\langle x \rangle A local encoding

The ‘local’ encodings are intended for font encodings which are only locally available, for example a font containing an organisation’s logo in various sizes.

There are far too many font families to list them all, but some common ones are:

- cmr Computer Modern Roman
- cmss Computer Modern Sans
- cmtt Computer Modern Typewriter
- cmm Computer Modern Math Italic
- cmsy Computer Modern Math Symbols
- cmmex Computer Modern Math Extensions
- ptm Adobe Times
- phv Adobe Helvetica
- pcr Adobe Courier

The most common values for the font series are:

- m Medium
- b Bold
- bx Bold extended
- sb Semi-bold
- c Condensed

The most common values for the font shape are:

- n Normal (that is ‘upright’ or ‘roman’)
- it Italic
- sl Slanted (or ‘oblique’)
- sc Caps and small caps

The font size is specified as a dimension, for example 10pt or 1.5in or 3mm. These five parameters specify every \LaTeX{} font, for example:
<table>
<thead>
<tr>
<th><strong>\LaTeX</strong> specification</th>
<th>Font</th>
<th><strong>\TeX</strong> font name</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT1 cmr m n 10pt</td>
<td>Computer Modern Roman 10pt</td>
<td>cmr10</td>
</tr>
<tr>
<td>OT1 cmss s m sl 12pt</td>
<td>Computer Modern Sans Oblique 12pt</td>
<td>cmssi12</td>
</tr>
<tr>
<td>OML cmm m m t m t 10pt</td>
<td>Computer Modern Math Italic 10pt</td>
<td>cmmi10</td>
</tr>
<tr>
<td>T1 ptm b it 18pt</td>
<td>Adobe Times Bold Italic 18pt</td>
<td>ptmbq at 18pt</td>
</tr>
</tbody>
</table>

These five parameters are displayed whenever \LaTeX{} gives an overfull box warning, for example:

\begin{verbatim}
\overfull \hbox (3.80856 pt too wide) in paragraph at lines 314--318
\end{verbatim}

\[ \text{Normally } \square \text{ and } \square \text{ will be iden-ti-cal,} \]

The author commands for fonts set the five attributes:

<table>
<thead>
<tr>
<th>Author command</th>
<th>Attribute</th>
<th>Value in article class</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{...} or \sffamily</td>
<td>family</td>
<td>cmss</td>
</tr>
<tr>
<td>\texttt{...} or \ttfamily</td>
<td>family</td>
<td>cmtt</td>
</tr>
<tr>
<td>\texttt{...} or \mdseries</td>
<td>series</td>
<td>m</td>
</tr>
<tr>
<td>\texttt{...} or \upshape</td>
<td>shape</td>
<td>n</td>
</tr>
<tr>
<td>\texttt{...} or \itshape</td>
<td>shape</td>
<td>it</td>
</tr>
<tr>
<td>\texttt{...} or \slshape</td>
<td>shape</td>
<td>sl</td>
</tr>
<tr>
<td>\texttt{...} or \scshape</td>
<td>shape</td>
<td>sc</td>
</tr>
<tr>
<td>\tiny</td>
<td>size</td>
<td>5pt</td>
</tr>
<tr>
<td>\scriptsize</td>
<td>size</td>
<td>7pt</td>
</tr>
<tr>
<td>\footnotesize</td>
<td>size</td>
<td>8pt</td>
</tr>
<tr>
<td>\small</td>
<td>size</td>
<td>9pt</td>
</tr>
<tr>
<td>\normalsize</td>
<td>size</td>
<td>10pt</td>
</tr>
<tr>
<td>\large</td>
<td>size</td>
<td>12pt</td>
</tr>
<tr>
<td>\Large</td>
<td>size</td>
<td>14.4pt</td>
</tr>
<tr>
<td>\LARGE</td>
<td>size</td>
<td>17.28pt</td>
</tr>
<tr>
<td>\huge</td>
<td>size</td>
<td>20.74pt</td>
</tr>
<tr>
<td>\Huge</td>
<td>size</td>
<td>24.88pt</td>
</tr>
</tbody>
</table>

The values used by these commands are determined by the document class, using the parameters defined in Section 2.4.

Note that there are no author commands for selecting new encodings. These should be provided by packages, such as the fontenc package.

This section does not explain how \LaTeX{} font specifications are turned into \TeX{} font names. This is described in Section 4.

## 2.2 Selection commands

The low-level commands used to select a text font are as follows.
Each of these commands sets one of the font attributes; \fontsize also sets \baselineskip. The actual font in use is not altered by these commands, but the current attributes are used to determine which font to use after the next \selectfont command.

\selectfont

Selects a text font, based on the current values of the font attributes.

Warning: there must be a \selectfont command immediately after any settings of the font parameters by (some of) the five \font\{parameter\} commands, before any following text. For example, it is legal to say:

\fontfamily{ptm}\fontseries{b}\selectfont Some text.

but it is not legal to say:

\fontfamily{ptm} Some \fontseries{b}\selectfont text.

You may get unexpected results if you put text between a \font\{parameter\} command and a \selectfont command.

\usefont\{(encoding)\}\{family\}\{series\}\{shape\}

A short hand for the equivalent \font... commands followed by a call to \selectfont.

2.3 Internals

The current values of the font attributes are held in internal macros.

\f@encoding
\f@family
\f@series
\f@shape
\f@size
\f@baselineskip
\tf@size
\ssf@size
\esf@size

These hold the current values of the encoding, the family, the series, the shape,
the size, the baseline skip, the main math size, the ‘script’ math size and the ‘scriptscript’ math size. The last three are accessible only within a formula; outside of math they may contain arbitrary values.

For example, to set the size to 12 without changing the baseline skip:

```
\fontsize{12}{\f@baselineskip}
```

However, you should never alter the values of the internal commands directly; they must only be modified using the low-level commands like `\fontfamily`, `\fontseries`, etc. If you disobey this warning you might produce code that loops.

### 2.4 Parameters for author commands

The parameter values set by author commands such as `\textrm` and `\rmfamily`, etc. are not hard-wired in to TeX; instead these commands use the values of a number of parameters set by the document class and packages. For example, `\rmdefault` is the name of the default family selected by `\textrm` and `\rmfamily`. Thus to set a document in Adobe Times, Helvetica and Courier, the document designer specifies:

```
\renewcommand{\rmdefault}{ptm}
\renewcommand{\sfdefault}{phv}
\renewcommand{\ttdefault}{pcr}
```

The encoding, family, series and shape of the main body font. By default these are OT1, `\rmdefault`, m and n. Note that since the default family is `\rmdefault`, this means that changing `\rmdefault` will change the main body font of the document.

```
\rmdefault
\sfdefault
\ttfamily
```

The families selected by `\textrm`, `\rmfamily`, `\textsf`, `\sffamily`, `\texttt` and `\ttfamily`. By default these are `cmr`, `cmmss` and `cmtt`.
The series selected by \textbf, \bfseries, \textmd and \mdseries. By default these are bx and m. These values are suitable for the default families used. If other fonts are used as standard document fonts (for example, certain PostScript fonts) it might be necessary to adjust the value of \bfdefault to be since only a few such families have a 'bold extended' series. An alternative (taken for the fonts provided by \psnfss) is to define silent substitutions from bx series to b series with special \DeclareFontShape declarations and the ssub size function, see Section 4.4.

The shapes selected by \textit, \itshape, \textsl, \slshape, \textsc, \scshape, \textup and \upshape. By default these are it, sl, sc and n.

Note that there are no parameters for the size commands. These should be defined directly in class files, for example:

\renewcommand{\normalsize}{\font size {10}{12}{selectfont}

More elaborate examples (setting additional parameters when the text size is changed) can be found in classes.dtx the source documentation for the classes article, report, and book.

2.5 Special font declaration commands

\DeclareFixedFont\{\texttt\} {\texttt ENC} {\texttt family} {\texttt series} {\texttt shape} {\texttt size}\}

Declares command \texttt{cmd} to be a font switch which selects the font that is specified by the attributes \texttt{ENC}, \texttt{family}, \texttt{series}, \texttt{shape}, and \texttt{size}.

The font is selected without any adjustments to baselineskip and other surrounding conditions.

This example makes \texttt{\picturechar .} select a small dot very quickly.

\DeclareFixedFont\{\picturechar\} {OT1}{cmr}{m}{n}{5}

\DeclareTextFontCommand \texttt{cmd} \texttt{font-switches}\}

Declares command \texttt{cmd} to be a font command with one argument. The current font attributes are locally modified by \texttt{font-switches} and then the argument of \texttt{cmd} is typeset in the resulting new font.
Commands defined by \texttt{\DeclareTextFontCommand} automatically take care of any necessary italic correction (on either side).

The following example shows how \texttt{\textrm} is defined by the kernel.

\texttt{\DeclareTextFontCommand{\textrm}{\rmfamily}}

To define a command that always typeset its argument in the italic shape of the main document font you could declare:

\texttt{\DeclareTextFontCommand{\normalit}{\normalfont\itshape}}

This declaration can be used to change the meaning of a command; if \texttt{\textit{cmd}} is already defined, a log that it has been redefined is put in the transcript file.

\texttt{\DeclareOldFontCommand \{\textit{cmd}\} \{\textswab\} \{\mathit\} }

Declares command \texttt{\textit{cmd}} to be a font switch (i.e. used with the syntax \texttt{\{\textit{cmd}\}...}) having the definition \texttt{\textswab} when used in text and the definition \texttt{\mathit} when used in a formula. Math alphabet commands, like \texttt{\mathit}, when used within \texttt{\mathit} should not have an argument. Their use in this argument causes their semantics to change so that they here act as a font switch, as required by the usage of the \texttt{\textit{cmd}}.

This declaration is useful for setting up commands like \texttt{\textrm} to behave as they did in \LaTeX{} 2.09. We strongly urge you not to misuse this declaration to invent new font commands.

The following example defines \texttt{\textit} to produce the italic shape of the main document font if used in text and to switch to the font that would normally be produced by the math alphabet \texttt{\mathit} if used in a formula.

\texttt{\DeclareOldFontCommand{\textit}{\normalfont\itshape}{\mathit}}

This declaration can be used to change the meaning of a command; if \texttt{\textit{cmd}} is already defined, a log that it has been redefined is put in the transcript file.

\section{Math fonts}

This section describes the commands available to class and package writers for specifying math fonts and math commands.
3.1 Math font attributes

The selection of fonts within math mode is quite different to that of text fonts.

Some math fonts are selected explicitly by one-argument commands such as \textsf{max} or \textbf{vec}: these are called math alphabets. These math alphabet commands affect only the font used for letters and symbols of type \textalpha{} (see Section 3.6); other symbols within the argument will be left unchanged. The predefined math alphabets are:

<table>
<thead>
<tr>
<th>Alphabet</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>\textnormal</td>
<td>default</td>
<td>abcXYZ</td>
</tr>
<tr>
<td>\textrm</td>
<td>roman</td>
<td>abcXYZ</td>
</tr>
<tr>
<td>\textbf</td>
<td>bold roman</td>
<td>\textbf{abcXYZ}</td>
</tr>
<tr>
<td>\textsf</td>
<td>sans serif</td>
<td>abcXYZ</td>
</tr>
<tr>
<td>\textit</td>
<td>text italic</td>
<td>abcXYZ</td>
</tr>
<tr>
<td>\texttt</td>
<td>typewriter</td>
<td>abcXYZ</td>
</tr>
<tr>
<td>\textcal</td>
<td>calligraphic</td>
<td>$\mathcal{XYZ}$</td>
</tr>
</tbody>
</table>

Other math fonts are selected implicitly by TeX for symbols, with commands such as \oplus (producing $\oplus$) or with straight characters like $>$ or $+$. Fonts containing such math symbols are called math symbol fonts. The predefined math symbol fonts are:

<table>
<thead>
<tr>
<th>Symbol font</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>operators</td>
<td>symbols from \textrm</td>
<td>[ + ]</td>
</tr>
<tr>
<td>letters</td>
<td>symbols from \textnormal</td>
<td>$&lt; * &gt;$</td>
</tr>
<tr>
<td>symbols</td>
<td>most \TeX{} symbols</td>
<td>$&lt; &gt;$</td>
</tr>
<tr>
<td>largesymbols</td>
<td>large symbols</td>
<td>$\sum \Pi f$</td>
</tr>
</tbody>
</table>

Some math fonts are both math alphabets and math symbol fonts, for example \textsf{} and operators are the same font, and \textnormal{} and letters are the same font.

Math fonts in \TeX{} have the same five attributes as text fonts: encoding, family, series, shape and size. However, there are no commands that allow the attributes to be individually changed. Instead, the conversion from math fonts to these five attributes is controlled by the math version. For example, the \textnormal{} math version maps:
The bold math version is similar except that it contains bold fonts. The command $\textbackslash$boldmath selects the bold math version.

Math versions can only be changed outside of math mode.

The two predefined math versions are:

```
\texttt{normal} \quad \texttt{bold}
```

Packages may define new math alphabets, math symbol fonts, and math versions. This section describes the commands for writing such packages.

### 3.2 Selection commands

There are no commands for selecting symbol fonts. Instead, these are selected indirectly through symbol commands like $\textbackslash$oplus. Section 3.6 explains how to define symbol commands.

```
\texttt{\textbackslash mathnormal}\{\texttt{\textbackslash math}\}
\texttt{\textbackslash mathcal}\{\texttt{\textbackslash math}\}
\texttt{\textbackslash mathrm}\{\texttt{\textbackslash math}\}
\texttt{\textbackslash mathtt}\{\texttt{\textbackslash math}\}
```

Each math alphabet is a command which can only be used inside math mode. For example, $x + \texttt{\textbackslash mathsf\{y\}} + \texttt{\textbackslash mathcal\{\mathcal{Z}\}}$ produces $x + y + \mathcal{Z}$.

```
\texttt{\textbackslash mathversion}\{\texttt{\textbackslash version-name}\}
```

This command selects a math version; it can only be used outside math mode. For example, $\texttt{\textbackslash boldmath}$ is defined to be $\texttt{\textbackslash mathversion\{\texttt{bold}\}}$.
### 3.3 Declaring math versions

\begin{verbatim}
\DeclareMathVersion \{\{version-name\}\}
\end{verbatim}

Defines \texttt{\{version-name\}} to be a math version.

The newly declared version is initialised with the defaults for all symbol fonts
and math alphabets declared so far (see the commands \texttt{\DeclareSymbolFont}
and \texttt{\DeclareMathAlphabet}).

If used on an already existing version, an information message is written to the
transcript file and all previous \texttt{\SetSymbolFont} or \texttt{\SetMathAlphabet}
declarations for this version are overwritten by the math alphabet and symbol font
defaults, i.e. one ends up with a virgin math version.

Example:

\begin{verbatim}
\DeclareMathVersion{normal}
\end{verbatim}

### 3.4 Declaring math alphabets

\begin{verbatim}
\DeclareMathAlphabet \{\{math-alph\}\} \{\{encoding\}\} \{\{family\}\} \{\{series\}\} \{\{shape\}\}
\end{verbatim}

Defines \texttt{\{math-alph\}} to be a new math alphabet.

The arguments \texttt{\{encoding\}} \texttt{\{family\}} \texttt{\{series\}} \texttt{\{shape\}} are the default values for
this math alphabet in all math versions; these can be reset later for a particular
math version by a \texttt{\SetMathAlphabet} command. If \texttt{\{shape\}} is empty then the
\texttt{\{math-alph\}} is declared to be invalid in all versions, unless it is set by a later
\texttt{\SetMathAlphabet} command.

Checks that \texttt{\{math-alph\}} can be used and that \texttt{\{encoding\}} is a valid encoding
scheme.

In these examples, \texttt{\foo} is defined everywhere but \texttt{\baz}, by default, is defined
nowhere.

\begin{verbatim}
\DeclareMathAlphabet{\foo}{OT1}{cmtt}{m}{n}
\DeclareMathAlphabet{\baz}{OT1}{m}{n}
\end{verbatim}

\begin{verbatim}
\SetMathAlphabet \{\{math-alph\}\} \{\{version-name\}\} \{\{encoding\}\} \{\{family\}\} \{\{series\}\} \{\{shape\}\}
\end{verbatim}

Changes, or sets, the font for the math alphabet \texttt{\{math-alph\}} in math version
\texttt{\{version-name\}} to \texttt{\{encoding\}}\texttt{\{family\}}\texttt{\{series\}}\texttt{\{shape\}}.

Checks that \texttt{\{math-alph\}} is a math alphabet, \texttt{\{version-name\}} is a math version
and \texttt{\{encoding\}} is a known encoding scheme.

This example defines \texttt{\baz} for the ‘normal’ math version only:
Note that this declaration is not used for all math alphabets: Section 3.5 describes \DeclareSymbolFontAlphabet, which is used to set up math alphabets contained in fonts which have been declared as symbol fonts.

3.5 Declaring symbol fonts

\DeclareSymbolFont{\langle sym-font-name\rangle}{\langle encoding\rangle}{\langle family\rangle}{\langle series\rangle}{\langle shape\rangle}

Defines \langle sym-font-name\rangle to be a new symbol font.

The arguments \langle encoding\rangle \langle family\rangle \langle series\rangle \langle shape\rangle are the default values for this symbol font in all math versions; these can be reset later for a particular math version by a \SetSymbolFont command.

Checks that \langle sym-font-name\rangle can be used and that \langle encoding\rangle is a declared encoding scheme.

For example, the following sets up the first four standard math symbol fonts:

\begin{verbatim}
\DeclareSymbolFont{operators}{OT1}{cmr}{m}{n}
\DeclareSymbolFont{letters}{OML}{cmm}{m}{it}
\DeclareSymbolFont{symbols}{OMS}{cmsy}{m}{n}
\DeclareSymbolFont{largesymbols}{OMX}{cmex}{m}{n}
\end{verbatim}

\SetSymbolFont{\langle sym-font-name\rangle}{\langle version name\rangle}{\langle encoding\rangle}{\langle family\rangle}{\langle series\rangle}{\langle shape\rangle}

Changes the symbol font \langle sym-font-name\rangle for math version \langle version name\rangle to \langle encoding\rangle \langle family\rangle \langle series\rangle \langle shape\rangle.

Checks that \langle sym-font-name\rangle is a symbol font, \langle version name\rangle is a known math version and \langle encoding\rangle is a declared encoding scheme.

For example, the following come from the set up of the ‘bold’ math version:

\begin{verbatim}
\SetSymbolFont{operators}{bold}{OT1}{cmr}{bx}{n}
\SetSymbolFont{letters}{bold}{OML}{cmm}{b}{it}
\end{verbatim}

\DeclareSymbolFontAlphabet{\langle math-alph\rangle}{\langle sym-font-name\rangle}

Allows the previously declared symbol font \langle sym-font-name\rangle to be also the math alphabet \langle id\rangle (in all math versions).

This declaration should be used in preference to \DeclareMathAlphabet and \SetMathAlphabet when a math alphabet is the same as a symbol font; this
is because it makes better use of the limited number (only 16) of \TeX’s math groups.

Checks that \texttt{\textit{math-alph}} can be defined and that \texttt{\textit{sym-font-name}} is a symbol font.

Example:

\begin{verbatim}
\DeclareSymbolFontAlphabet{\mathrm}{operators}
\DeclareSymbolFontAlphabet{\mathcal}{symbols}
\end{verbatim}

3.6 Declaring math symbols

\texttt{\textbackslash DeclareMathSymbol \{\symbol\} \{\type\} \{\sym-font-name\} \{\slot\}}

The \texttt{\symbol\} can be either a single character such as ‘>’, or a macro name, such as \texttt{\sum}.

Defines the \texttt{\symbol\} to be a math symbol of type \texttt{\type\} in slot \texttt{\slot\} of symbol font \texttt{\sym-font-name}. The \texttt{\type\} can be given as a number or as a command:

<table>
<thead>
<tr>
<th>Type</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 or \texttt{\mathord}</td>
<td>Ordinary</td>
<td>\alpha</td>
</tr>
<tr>
<td>1 or \texttt{\mathop}</td>
<td>Large operator</td>
<td>\sum</td>
</tr>
<tr>
<td>2 or \texttt{\mathbin}</td>
<td>Binary operation</td>
<td>\times</td>
</tr>
<tr>
<td>3 or \texttt{\mathrel}</td>
<td>Relation</td>
<td>\leq</td>
</tr>
<tr>
<td>4 or \texttt{\mathopen}</td>
<td>Opening</td>
<td>\langle</td>
</tr>
<tr>
<td>5 or \texttt{\mathclose}</td>
<td>Closing</td>
<td>\rangle</td>
</tr>
<tr>
<td>6 or \texttt{\mathpunct}</td>
<td>Punctuation</td>
<td>;</td>
</tr>
<tr>
<td>7 or \texttt{\mathalpha}</td>
<td>Alphabet character</td>
<td>A</td>
</tr>
</tbody>
</table>

Only symbols of type \texttt{\mathalpha} will be affected by math alphabet commands: within the argument of a math alphabet command they will produce the character in slot \texttt{\slot\} of that math alphabet’s font. Symbols of other types will always produce the same symbol (within one math version).

\texttt{\textbackslash DeclareMathSymbol} allows a macro \texttt{\symbol\} to be redefined only if it was previously defined to be a math symbol. It also checks that the \texttt{\sym-font-name} is a declared symbol font.

Example:

\begin{verbatim}
\DeclareMathSymbol{\alpha}{0}{letters}{"0B}
\DeclareMathSymbol{\lessdot}{\mathbin}{AMSb}{"0C}
\DeclareMathSymbol{\alphld}{\mathalpha}{AMSb}{"0C}
\end{verbatim}
\DeclareMathDelimiter \{cmd\} \{type\} \{sym-font-name-1\} \{slot-1\} \{sym-font-name-2\} \{slot-2\}

Defines \texttt{cmd} to be a math delimiter where the small variant is in slot \texttt{slot-1} of symbol font \texttt{sym-font-name-1} and the large variant is in slot \texttt{slot-2} of symbol font \texttt{sym-font-name-2}. Both symbol fonts must have been declared previously.

Checks that \texttt{sym-font-name-1} and \texttt{sym-font-name-2} are both declared symbol fonts.

If \TeX{} is not looking for a delimiter, \texttt{cmd} is treated just as if it had been defined with \texttt{\DeclareMathSymbol} using \texttt{type}, \texttt{sym-font-name-1} and \texttt{slot-1}. In other words, if a command is defined as a delimiter then this automatically defines it as a math symbol.

Example:

\begin{verbatim}
\DeclareMathDelimiter{\langle}{\mathopen}{symbols}{"68}
            {largesymbols}{"0A}
\end{verbatim}

\DeclareMathAccent \{cmd\} \{type\} \{sym-font-name\} \{slot\}

Defines \texttt{cmd} to act as a math accent.

The accent character comes from slot \texttt{slot} in \texttt{sym-font-name}. The \texttt{type} can be either \texttt{\mathord} or \texttt{\mathalpha}; in the latter case the accent character changes font when used in a math alphabet.

Example:

\begin{verbatim}
\DeclareMathAccent{\acute}{\mathalpha}{operators}{"13}
\DeclareMathAccent{\vec}{\mathord}{letters}{"7E}
\end{verbatim}

\DeclareMathRadical \{cmd\} \{sym-font-name-1\} \{slot-1\} \{sym-font-name-2\} \{slot-2\}

Defines \texttt{cmd} to be a radical where the small variant is in slot \texttt{slot-1} of symbol font \texttt{sym-font-name-1} and the large variant is in slot \texttt{slot-2} of symbol font \texttt{sym-font-name-2}. Both symbol fonts must have been declared previously.

Example (probably the only use for it!):

\begin{verbatim}
\DeclareMathRadical{\sqrt}{symbols}{"70}{largesymbols}{"70}
\end{verbatim}

3.7 Declaring math sizes

\DeclareMathSizes \{t-size\} \{mt-size\} \{s-size\} \{ss-size\}

Declares that \texttt{mt-size} is the (main) math text size, \texttt{s-size} is the ‘script’ size and \texttt{ss-size} the ‘scriptscript’ size to be used in math, when \texttt{t-size} is
the current text size. For text sizes for which no such declaration is given the ‘script’ and ‘scriptscript’ size will be calculated and then fonts are loaded for the calculated sizes or the best approximation (this may result in a warning message).

Normally, (t-size) and (mt-size) will be identical; however, if, for example, PostScript text fonts are mixed with bit-map math fonts then you may not have available a (mt-size) for every (t-size).

Example:

\DeclareMathSizes{13.82}{12.4}{10}{7}

4 Font installation

This section explains how \LaTeX`s font attributes are turned into TeX font specifications.

4.1 Font definition files

The description of how \LaTeX font attributes are turned into TeX fonts is usually kept in a font definition (.fd) file. The .fd file for family ⟨family⟩ in encoding ⟨encoding⟩ is called ⟨ENC⟩⟨family⟩.fd, for example OT1cmr.fd for Computer Modern Roman or T1ptm.fd for Adobe Times.

Whenever \LaTeX encounters an encoding/family combination that it does not know (e.g. if the document designer says \fontfamily{ptm}\selectfont) then \LaTeX attempts to load the appropriate .fd file. “Not known” means: there was no \DeclareFontFamily declaration issued for this encoding/family combination.

The declarations in the .fd file are responsible for telling \LaTeX how to load fonts for that encoding/family combination. If the .fd file could not be found, a warning is issued and font substitutions are made.

4.2 Font definition file commands

The .fd files should contain only commands from this section. Note that those commands can also be used outside a .fd file: they can be put in package or class files, or even in the preamble of a document.

\ProvidesFile{⟨file-name⟩}[⟨release-info⟩]

The .fd file should announce itself with a \ProvidesFile command, as described in \TeX for Class and Package Writers. For example:
\ProvidesFile{tiptm.fd}[1994/06/01 Adobe Times font definitions]

\DeclareFontFamily{{T/1/}}{cmtt}{\hyphenchar\font=-1}

Each .fd file should contain exactly one \DeclareFontFamily command, and it should be for the appropriate encoding/family combination.

\DeclareFontShape{{OT/1/}}{cmr}{m}{n}{<5-6> cmr/m/n <6> cmr18 <7> cmr19 ...

An .fd file can contain any number of \DeclareFontShape commands, which should be for the appropriate \encoding{} and \family{}.

The font family declarations for the OT1-encoded fonts now all contain:

New feature
1996/06/01
This enables the use of an alternative \hyphenchar in other encodings whilst maintaining the correct value for all fonts.

4.3 Font file loading information

The information which tells \LaTeX exactly which font (.tfm) files to load is contained in the \texttt{loading-info} part of a \fontshape declaration. This part consists of one or more \fontshape entries, each of which has the following form:

\begin{verbatim}
\langle fontshape-decl \rangle ::= \langle size-infos \rangle \langle font-info \rangle
\langle size-infos \rangle ::= \langle size-infos \rangle \langle size-info \rangle | \langle size-info \rangle
\langle size-info \rangle ::= "<" \langle number-or-range \rangle ">">
\langle font-info \rangle ::= [ \langle size-function \rangle "*" ] [ "[" \langle optarg \rangle "]" ] \langle fontarg \rangle
\end{verbatim}

The \texttt{number-or-range} denotes the size or size-range for which this entry applies.

If it contains a hyphen it is a range: lower bound on the left (if missing, zero implied), upper bound on the right (if missing, \infty implied). For ranges, the upper bound is \textit{not} included in the range and the lower bound is.

Examples:

\begin{verbatim}
<10>    simple size 10pt only
<-8>    range    all sizes less than 8pt
<8-14.4> range    all sizes greater than or equal to 8pt
           but less than 14.4pt
<14.4->  range    all sizes greater than or equal 14.4pt
\end{verbatim}

If more than one \texttt{size-info} entry follows without any intervening \texttt{font-info}, they all share the next \texttt{font-info}.

The \texttt{size-function}, if present, handles the use of \texttt{font-info}. If not present, the 'empty' \texttt{size-function} is assumed.

All the \texttt{size-info}s are inspected in the order in which they appear in the font shape declaration. If a \texttt{size-info} matches the requested size, its \texttt{size-function} is executed. If \texttt{\external@font} is non-empty afterwards this process stops, otherwise the next \texttt{size-info} is inspected. (See also \fontshapefunction.)

If this process does not lead to a non-empty \texttt{\external@font}, \LaTeX tries the nearest simple size. If the entry contains only ranges an error is returned.
4.4 Size functions

LaTeX provides the following size functions, whose ‘inputs’ are \((fontary)\) and \((optary)\) (when present).

‘’ (empty) Load the external font \((fontary)\) at the user-requested size. If \((optary)\) is present, it is used as the scale-factor.

s Like the empty function but without terminal warnings, only loggings.

gen Generates the external font from \((fontary)\) followed by the user-requested size, e.g. \(<8> <9> <10> \) \(gen * cmnt\)

sgen Like the ‘gen’ function but without terminal warnings, only loggings.

genb Generates the external font from \((fontary)\) followed by the user-requested size, using the conventions of the ‘ec’ fonts. e.g. \(<10.98>\) \(genb * dctt\) produces \(dctt1098\).

sgenb Like the ‘genb’ function but without terminal warnings, only loggings.

sub Tries to load a font from a different font shape declaration given by \((fontary)\) in the form \((family)/(series)/(shape)\).

ssub Silent variant of ‘sub’, only loggings.

subf Like the empty function but issues a warning that it has to substitute the external font \((fontary)\) because the desired font shape was not available in the requested size.

ssubf Silent variant of ‘subf’, only loggings.

fixed Load font \((fontary)\) as is, disregarding the user-requested size. If present, \((optary)\) gives the “at ... pt” size to be used.

sfixed Silent variant of ‘fixed’, only loggings.

Examples for the use of most of the above size functions can be found in the file \(cmfonts.fdd\)—the source for the standard \(fd\) files describing the Computer Modern fonts by Donald Knuth.

\(\texttt{\textbackslash DeclareSizeFunction \{(name)\} \{(code)\}}\)

Declares a size-function \((name)\) for use in \(\texttt{\textbackslash DeclareFontShape}\) commands. The interface is still under development but there should be no real need to define new size functions.

The \((code)\) is executed when the size or size-range in \(\texttt{\textbackslash DeclareFontShape}\) matches the user-requested size.
The arguments of the size-function are automatically parsed and placed into `\mandatory@arg` and `\optional@arg` for use in `<code>`. Also available, of course, is `\f@size`, which is the user-requested size.

To signal success `<code>` must define the command `\external@font` to contain the external name and any scaling options (if present) for the font to be loaded.

This example sets up the ‘empty’ size function (simplified):

```latex
\DeclareSizeFunction{}
{\edef\external@font{\mandatory@arg\space at\f@size}}
```

5 Encodings

This section explains how to declare and use new font encodings and how to declare commands for use with particular encodings.

5.1 The fontenc package

Users can select new font encodings using the `fontenc` package. The `fontenc` package has options for encodings; the last option becomes the default encoding. For example, to use the OT2 (Washington University Cyrillic encoding) and T1 encodings, with T1 as the default, an author types:

```latex
\usepackage[OT2,T1]{fontenc}
```

This package loads the encoding definition files (``enc.def`` files) for each font encoding `\texttt{ENC}` given as an option but not already declared; it also sets `\encodingdefault` to be the last encoding in the option list.

LaTeX currently predefines the OT1 and T1 text encodings, and provides the files `OT1enc.def` and `T1enc.def`. Other encoding set-ups might be added to the distribution at a later stage.

Thus the example above loads the file `OT2enc.def` and sets `\encodingdefault` to T1.

*Note*: If you wish to use T1-encoded fonts other than the ‘cmr’ family then you may need to load the package (e.g, `times`) that selects the fonts before loading `fontenc` (this prevents the system from attempting to load any T1-encoded fonts from the ‘cmr’ family).
5.2 Encoding definition files

**Warning:** Some aspects of the contents of font definition files are still under development. Therefore, the current versions of the files `OT1enc.def` and `T1enc.def` are temporary versions and should not be used as models for producing further such files. For further information you should read the documentation in `ltoutenc.dtx`.

The declarations in the encoding definition file are responsible for declaring the encoding and telling `LaTeX` how to produce characters in this encoding.

The `<ENC>` `.def` files should contain only commands from this section. As with the font definition file commands, it is also possible (although normally not necessary) to use these declarations directly within a class or package file.

\begin{verbatim}
\ProvidesFile{{file-name}}[\{release-info\}]
\end{verbatim}

The `<ENC>` `.def` file should announce itself with a `\ProvidesFile` command, described in `LaTeX` 2e for Class and Package Writers. For example:

\begin{verbatim}
\ProvidesFile{OT2enc.def}
\end{verbatim}

\begin{verbatim}
[1994/06/01 Washington University Cyrillic encoding]
\end{verbatim}

\begin{verbatim}
\DeclareFontEncoding \{\{encoding\}\} \{\{text-settings\}\} \{\{math-settings\}\}
\end{verbatim}

Declares a new encoding scheme `<encoding>`.

The `<text-settings>` are declarations which are executed every time `\selectfont` changes the encoding to be `<encoding>`.

The `<math-settings>` are similar but are for math alphabets. They are executed whenever a math alphabet with this encoding is called.

Spaces within the arguments are ignored to avoid surplus spaces in the document. If a real space is necessary use `\space`.

Example:

\begin{verbatim}
\DeclareFontEncoding{OT1}{}
\end{verbatim}

Some author commands need to change their definition depending on which encoding is currently in use. For example, in the `OT1` encoding, the letter ‘Æ’ is in slot "1D, whereas in the `T1` encoding it is in slot "C6. So the definition of `\AE` has to change depending on whether the current encoding is `OT1` or `T1`. The following commands allow this to happen.
\DeclareTextCommand{\cmd}{\encoding}{\num}{\default}{\definition}

This command is like \newcommand, except that it defines a command which is
specific to one encoding. For example, the definition of \k in the T1 encoding is:

\DeclareTextCommand{\k}{T1}{1}
  {\oalign{\null#1\crcr\hidewidth\char12}}

\DeclareTextCommands takes the same optional arguments as \newcommand.
The resulting command is robust, even if the code in \definition is fragile.
It does not produce an error if the command has already been defined but logs
the redefinition in the transcript file.

\ProvideTextCommand{\cmd}{\encoding}{\num}{\default}{\definition}

New feature
1994/12/01

This command is the same as \DeclareTextCommand, except that if \cmd is
already defined in encoding \encoding, then the definition is ignored.

\DeclareTextSymbol{\cmd}{\encoding}{\slot}

This command defines a text symbol with slot \slot in the encoding. For
example, the definition of \ss in the OT1 encoding is:

\DeclareTextSymbol{\ss}{OT1}{25}

It does not produce an error if the command has already been defined but logs
the redefinition in the transcript file.

\DeclareTextAccent{\cmd}{\encoding}{\slot}

This command declares a text accent, with the accent taken from slot \slot in
the encoding. For example, the definition of \" in the OT1 encoding is:

\DeclareTextAccent{"}{OT1}{127}

It does not produce an error if the command has already been defined but logs
the redefinition in the transcript file.

\DeclareTextComposite{\cmd}{\encoding}{\letter}{\slot}

This command declares that the composite letter formed from applying \cmd
to \letter is defined to be simply slot \slot in the encoding. The \letter should
be a single letter (such as a) or a single command (such as \i).
For example, the definition of `\{a\}` in the T1 encoding could be declared like this:

\DeclareTextComposite{\}{T1}{\{a\}}{225}

The `{cmd}` will normally have been previously declared for this encoding, either with using `\DeclareTextAccent`, or as a one-argument `\DeclareTextCommand`.

\begin{verbatim}
\DeclareTextCompositeCommand {{cmd}} {{encoding}} {{letter}} {{definition}}
\end{verbatim}

This is a more general form of `\DeclareTextComposite`, which allows for an arbitrary `{definition}`, not just a `{slot}`. The main use for this is to allow accents on `i` to act like accents on `\i`, for example:

\DeclareTextCompositeCommand{\'}{OT1}{i}{'\i'}

It has the same restrictions as `\DeclareTextComposite`.

### 5.3 Default definitions

The commands in `{ENC}.def` files allow encoding-specific commands to be defined, but they do not allow commands to be used in other encodings. For example, the OMS encoding contains the symbol `\text{\textcircled{c}}`, but we need to be able to use the command `\S` in any encoding, not just OMS.

To allow this, \TeX{} has commands for giving default definitions for commands, which are used when the command is not defined in the current encoding. For example, the default encoding for `\S` is OMS, and so in an encoding (such as OT1) which does not contain `\S`, the OMS version is selected. But in an encoding (such as T1) which does contain `\S`, the version for that encoding is used.

Note: These commands should not occur in `{ENC}.def` files, since these should only define commands for that encoding. They should instead be placed in packages.

\begin{verbatim}
\DeclareTextCommandDefault {{cmd}} {{definition}}
\end{verbatim}

This command allows an encoding-specific command to be given a default definition. For example, the default definition for `\copyright` is defined be be a circled `c` with:

\DeclareTextCommandDefault{\copyright}{\textcircled{c}}
These commands allow an encoding-specific command to be given a default encoding. For example, the default encoding for `\"` and `\ae` is set to be OT1 by:

\DeclareTextAccentDefault{\"}{OT1}
\DeclareTextSymbolDefault{\ae}{OT1}

Note that \DeclareTextAccentDefault can be used on any one-argument encoding-specific command, not just those defined with \DeclareTextAccent. Similarly, \DeclareTextSymbolDefault can be used on any encoding-specific command with no arguments, not just those defined with \DeclareTextSymbol.

For more examples of these definitions, see \texttt{loutenc.dtx}.

This command is the same as \DeclareTextCommandDefault, except that if the command already has a default definition, then the definition is ignored. This is useful to give ‘faked’ definitions of symbols which may be given ‘real’ definitions by other packages. For example, a package might give a fake definition of \texttt{\textonequarter} by saying:

\ProvideTextCommandDefault{\textonequarter}{$\frac{1}{4}$}

5.4 Encoding defaults

\DeclareFontEncodingDefaults \texttt{\{text-settings\}\{math-settings\}}

Declares \texttt{\{text-settings\}} and \texttt{\{math-settings\}} for all encoding schemes. These are executed before the encoding scheme dependent ones are executed so that one can use the defaults for the major cases and overwrite them if necessary using \DeclareFontEncoding.

If \texttt{\relax} is used as an argument, the current setting of this default is left unchanged.

This example is used by \texttt{amsfonts.sty} for accent positioning; it changes only the math settings:

\DeclareFontEncodingDefaults{\relax}{\def\accentclass@{7}}
\texttt{\textbackslash DeclareFontSubstitution \{\textit{encoding}\} \{\textit{family}\} \{\textit{series}\} \{\textit{shape}\}}

Declares the default values for font substitution which will be used when a font with encoding \textit{encoding} should be loaded but no font can be found with the current attributes.

These substitutions are local to the encoding scheme because the encoding scheme is never substituted! They are tried in the order \textit{shape} then \textit{series} and finally \textit{family}.

If no defaults are set up for an encoding, the values given by \texttt{\textbackslash DeclareErrorFont} are used.

The font specification for \textit{encoding}/\textit{family}/\textit{series}/\textit{shape} must have been defined by \texttt{\textbackslash DeclareFontShape} before the \texttt{\begin{document}} is reached.

Example:

\texttt{\textbackslash DeclareFontSubstitution\{T1\}\{cmr\}\{m\}\{n\}}

5.5 Case changing

\texttt{\textbackslash MakeUppercase \{\textit{text}\}} \hspace{1cm} \texttt{\textbackslash MakeLowercase \{\textit{text}\}}

\TeX\ provides the two primitives \texttt{\textbackslash uppercase} and \texttt{\textbackslash lowercase} for changing the case of text. Unfortunately, these \TeX\ primitives do not change the case of characters accessed by commands like \texttt{\ae} or \texttt{\aa}. To overcome this problem, \LaTeX\ provides these two commands.

In the long run, we would like to use all-caps fonts rather than any command like \texttt{\MakeUppercase} but this is not possible at the moment because such fonts do not exist.

For further details, see \texttt{clsguide.tex}.

In order that upper/lower-casing will work reasonably well, and in order to provide any correct hyphenation, \LaTeX\ 2e \textit{must} use, throughout a document, the same fixed table for changing case. The table used is designed for the font encoding T1; this works well with the standard \TeX\ fonts for all Latin alphabets but will cause problems when using other alphabets.

6 Miscellanea

This section covers the remaining font commands in \LaTeX\ and some other issues.
6.1 Font substitution

\DeclareErrorFont \{encoding\} \{family\} \{series\} \{shape\} \{size\}

Declares \{encoding\} \{family\} \{series\} \{shape\} to be the font shape used in cases where the standard substitution mechanism fails (i.e. would loop). For the standard mechanism see the command \DeclareFontSubstitution above.

The font specification for \{encoding\} \{family\} \{series\} \{shape\} must have been defined by \DeclareFontShape before the \begin{document} is reached.

Example:

\DeclareErrorFont\{OT1\}\{cmr\}\{m\}\{n\}\{10\}

\fontsubfuzz

This parameter is used to decide whether or not to produce a terminal warning if a font size substitution takes place. If the difference between the requested and the chosen size is less than \fontsubfuzz the warning is only written to the transcript file. The default value is 0.4pt. This can be redefined with \renewcommand, for example:

\renewcommand\{\fontsubfuzz\}\{0pt\} \% always warn

6.2 Preloading

\DeclarePreloadSizes \{encoding\} \{family\} \{series\} \{shape\} \{size-list\}

Specifies the fonts that should be preloaded by the format. These commands should be put in a preload.cfg file, which is read in when the \LaTeX\ format is being built. Read preload.dtx for more information on how to build such a configuration file.

Example:

\DeclarePreloadSizes\{OT1\}\{cmr\}\{m\}\{sl\}\{10,10.95,12\}

6.3 Accented characters

Accented characters in \LaTeX\ can be produced using commands such as \"a etc. The precise effect of such commands depends on the font encoding being used.

When using a font encoding that contains the accented characters as individual glyphs (such as the T1 encoding, in the case of \"a) words that contain such accented characters can be automatically hyphenated. For font encodings that
do not contain the requested individual glyph (such as the \OT1 encoding) such a command invokes typesetting instructions that produce the accented character as a combination of character glyphs and diacritical marks in the font. In most cases this involves a call to the \TeX primitive \texttt{\textbackslash accent}. Glyphs constructed as composites in this way inhibit hyphenation of the current word; this is one reason why the \T1 encoding is preferable to the original \TeX font encoding \OT1.

It is important to understand that commands like \texttt{\textbackslash"a} in \LaTeX 2\epsilon represent just a name for a single glyph (in this case ‘umlaut a’) and contain no information about how to typeset that glyph—thus it does not mean ‘put two dots on top of the character a’. The decision as to what typesetting routine to use will depend on the encoding of the current font and so this decision is taken at the last minute. Indeed, it is possible that the same input will be typeset in more than one way in the same document; for example, text in section headings may also appear in table of contents and in running heads; and each of these may use a font with a different encoding.

For this reason the notation \texttt{\textbackslash"a} is \textit{not} equivalent to:

\begin{verbatim}
\newcommand \chara {a} \"\chara
\end{verbatim}

In the latter case, \LaTeX does not expand the macro \texttt{\chara} but simply compares the notation (the string \"\chara) to its list of known composite notations in the current encoding; when it fails to find \"\chara it does the best it can and invokes the typesetting instructions that put the umlaut accent on top of the expansion of \chara. Thus, even if the font actually contains ‘ä’ as an individual glyph, it will not be used.

The low-level accent commands in \LaTeX are defined in such a way that it is possible to combine a diacritical mark from one font with a glyph from another font; for example, \texttt{\textparagraph} will produce \textparagraph. The umlaut here is taken from the \OT1 encoded font \texttt{cmr10} whilst the paragraph sign is from the \OMS encoded font \texttt{cmsy10}. (This example may be typographically silly but better ones would involve font encodings like \OT2 (Cyrillic) that might not be available at every site.)

There are, however, restrictions on the font-changing commands that will work within the argument to such an accent command. These are \TeXnical in the sense that they follow from the way that \TeX’s \texttt{\textbackslash accent} primitive works, allowing only a special class of commands between the accent and the accented character.

The following are examples of commands that will not work correctly as the accent will appear above a space: the font commands with text arguments (\texttt{\textbf{...}} and friends); all the font size declarations (\texttt{\textit{\textbackslash fontsize} and \textbf{\textbackslash large}} etc.); \texttt{\textbackslash usefont} and declarations that depend on it, such as \texttt{\textbackslash normalfont}; box commands (e.g. \texttt{\textbackslash mbox{...}}).
6.4 Naming conventions

- Math alphabet commands all start with \textbf{math}: examples are \textbf{mathbf}, \textbf{mathcal}, etc.

- The text font changing commands with arguments all start with \textit{text}: e.g. \textbf{textbf} and \textit{textit}. The exception to this is \emph{emph}, since it occurs very commonly in author documents and so deserves a shorter name.

- Names for encoding schemes are strings of up to three letters, all upper case. The LATEX project reserves the use of encodings starting with T (standard 256-long text encodings), M (standard 256-long math encodings), S (standard 256-long symbol encodings), OT (standard 128-long text encodings) and OM (standard 128-long math encodings). Please do not use the above starting letters for non-portable encodings. If new standard encoding emerge then we shall add them in a later release of LATEX.

- Encoding schemes which are local to a site should start with L.

- Font family names should contain up to five lower case letters. Where possible, these should conform to the Filenames for fonts font naming scheme.

- Font series names should contain up to four lower case letters.

- Font shapes should contain up to two letters lower case.

- Names for symbol fonts are built from lower and upper case letters with no restriction.

Whenever possible, you should use the series and shape names suggested in The LATEX Companion since this will make it easier to combine new fonts with existing fonts.

Where possible, text symbols should be named as \textit{text} followed by the Adobe glyph name: for example \textit{textonequarter} or \textit{textsterling}. Similarly, math symbols should be named as \textbf{math} followed by the glyph name, for example \textbf{mathonequarter} or \textbf{mathsterling}. Commands which can be used in text or math can then be defined using \texttt{ifmmode}, for example:

\begin{verbatim}
\DeclareRobustCommand\pounds{\%
   \ifmmode \mathsterling \else \textsterling \fi
}
\end{verbatim}

Note that commands defined in this way must be robust, in case they get put into a section title or other moving argument.
7 If you need to know more...

The `tracefnt` package provides for tracing the actions concerned with loading, substituting and using fonts. The package accepts the following options:

**errorshow** Write all information about font changes, etc. but only to the transcript file unless an error occurs. This means that information about font substitution will not be shown on the terminal.

**warningshow** Show all font warnings on the terminal. This setting corresponds to the default behaviour when this `tracefnt` package is not used!

**infoshow** Show all font warnings and all font info messages (that are normally only written to the transcript file) also on the terminal. This is the default when this `tracefnt` package is loaded.

**debugshow** In addition to what is shown by `infoshow`, show also changes of math fonts (as far as possible): beware, this option can produce a large amount of output.

**loading** Show the names of external font files when they are loaded. This option shows only ‘newly loaded’ fonts, not those already preloaded in the format or the class file before this `tracefnt` package becomes active.

**pausing** Turn all font warnings into errors so that \LaTeX{} will stop.

Warning: the actions of this package can change the layout of a document and even, in rare cases, produce clearly wrong output, so it should not be used in the final formatting of ‘real documents’.

**References**

