

Experimental unicode mathematical typesetting: The unicode-math package

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1 Introduction

This document describes the unicode-math package, which is an *experimental* implementation of a macro to unicode glyph encoding for mathematical characters. Its intended use is for \LaTeX , although it is conjectured that small effect needs to be spent to create a cross-format package that would also work with Omega.

As of \LaTeX v.0.995, maths characters can be accessed in unicode ranges. Now, a proper method must be invented for real unicode maths support. Before any code is written, I'm writing a specification in order to work out what is required. Fairly significant pieces of the NFSS may have to be re-written, and I'm a little unsure where to start.

2 Specification

This section will turn into 'User Interface' in time, presumably.

In the ideal case, a single unicode font will contain all maths glyphs we need. Barbara Beeton's STIX table provides the mapping between unicode maths glyphs and macro names (all 3298 — or however many — of them!). A single command

$\text{\setmathfont}[\langle font\ features \rangle][\langle font\ name \rangle]$

would implement this for every every symbol and alphabetic variant. That means x to x , \xi to ξ , \leq to \leq , etc., $\text{\mathcal{H}}$ to \mathcal{H} and so on, all for unicode glyphs within a single font.

Furthermore, this package should deal well with unicode characters for maths input, as well. This includes using literal Greek letters in formulae, resolving to upright or italic depending on preference.

Finally, maths versions must also be provided for. While I guess version selection in \LaTeX will remain the same, the specification for choosing the version fonts will probably be an optional argument:

$\text{\setmathfont}[Version=Bold, \langle font\ features \rangle][\langle font\ name \rangle]$

Instances above of

$[\langle font\ features \rangle][\langle font\ name \rangle]$

follow from my fontspec package, and therefore any additional $\langle font\ features \rangle$ specific to maths fonts will hook into fontspec's methods.

2.1 Using multiple fonts

There will probably be few cases where a single unicode maths font suffices. The upcoming STIX font comes to mind as a possible exception. It will therefore be necessary to delegate specific unicode ranges of glyphs to separate fonts. This syntax will also hook into the fontspec font feature processing:

$\text{\setmathfont}[Range=\langle unicode\ range \rangle, \langle font\ features \rangle][\langle font\ name \rangle]$

where *(unicode range)* is a comma-separated list of unicode slots and ranges such as {27D0–27EB, 27FF, 295B–297F}. Furthermore, preset names ranges could be used, such as `Mi scMathSymbol sA`, with such ranges based on unicode chunks. The amount of optimisation required here to achieve acceptable performance has yet to be determined. Techniques such as saving out unicode subsets based on *(unicode range)* data to be `\input` in the next \LaTeX run are a possibility, but at this stage, performance without such measures seems acceptable.

2.2 Script and scriptscript fonts/features

Cambria Math uses OpenType font features to activate smaller optical sizes for `scriptsize` and `scriptscriptsize` symbols (the B and C , respectively, in A_{BC}).

Other fonts will no doubt use entirely separate fonts. Both of these options must be taken into account. I hope this will be mostly automatic from the users' points of view. The `+ssty` feature can be detected and applied automatically, and appropriate optical size information embedded in the fonts will ensure this latter case. Fine tuning should be possible automatically with `fontspec` options. We might have to wait until `MnMath`, for example, before we really know.

File I

The unicode-math package

This is the package.

```
1 \ProvidesPackage{unicode-math}
2 [2007/01/03 v0.1 Unicode maths in XeLaTeX]
```

3 Things we need

Packages

```
3 \RequirePackage{fontspec}
```

Counters and conditionals

```
4 \newcounter{um@fam}
5 \newif\if@um@fontspec@feature
```

Shortcuts

```
6 \newcommand\um@PackageError[2]{\PackageError{unicode-math}{#1}{#2}}
7 \newcommand\um@PackageWarning[1]{\PackageWarning{unicode-math}{#1}}
8 \newcommand\um@PackageInfo[1]{\PackageInfo{unicode-math}{#1}}
```

3.1 Programming macros

`\um@Loop` See Kees van der Laan's various articles on \TeX programming:

`\um@Break`

```
9 \def\um@Loop#1\um@Pool{#1\um@Loop#1\um@Pool}
10 \def\um@Break#1\um@Pool{}
```

`\um@FOR` A simple 'for' loop implemented with the above. Takes a (predefined) counter `\csname` and increments it between two integers, iterating as we go.

```
11 \long\def\um@FOR #1 = [#2:#3] #4{%
12   \csname#1\endcsname =#2\relax
13   \um@Loop #4%
14   \expandafter\advance\csname#1\endcsname\@ne
15   \expandafter\ifnum\csname#1\endcsname>#3\relax
16     \expandafter\um@Break
17   \fi
18   \um@Pool}
```

`g/h/i/j/k/l/m/`

```
\newcount\@ii
\um@FOR \@ii = [7:13] {\@alph\@ii/}
```

3.2 Overcoming `\@onlypreamble`

TODO: This will be refined later! Sort out which macros actually have to be removed from the `\@preamblecmds` token list.

```
19 \def\@preamblecmds{}
```

4 Fundamentals

4.1 Enlarging the number of maths families

To start with, we've got a power of two as many `\fams` as before. So (from `ltxssbas.dtx`) we want to redefine

```
20 \def\new@mathgroup{\alloc@8\mathgroup\chardef\@cc1vi}
21 \let\newfam\new@mathgroup
```

Up to math fam 25 of 255.

```
\um@FOR @tempcnta = [1:20]
{\expandafter\newfam
 \csname mt\@alph@tempcnta\endcsname}
Up to math fam \the\mtt\ of 255.
```

This is sufficient for \LaTeX 's `\DeclareSymbolFont`-type commands to be able to define 256 named maths fonts. Now we need a new `\DeclareMathSymbol`.

4.2 `\DeclareMathSymbol` for unicode ranges

This is mostly an adaptation from L^AT_EX's definition.

```
\DeclareUnicodeMathSymbol #1 : Symbol, e.g., \alpha or a
                             #2 : Type, e.g., \mathalpha
                             #3 : Math font name, e.g., operators
                             #4 : Slot, e.g., "221E
```

```
22 \def\DeclareUnicodeMathSymbol#1#2#3#4{%
```

First ensure the math font (*e.g.*, operators) exists:

```
23 \expandafter\in@\csname sym#3\expandafter\endcsname
24 \expandafter{\group@list}%
25 \ifin@
```

No longer need here to perform the obfuscated hex conversion, since X_ET_EX-`mathchar` (and friends) has a more simplified input than T_EX's `\mathchar`.

```
26 \begingroup
```

The symbol to be defined can be either a command (`\alpha`) or a character (a). Branch for the former:

```
27 \if\relax\noexpand#1% is command?
28 \edef\reserved@a{\noexpand\in@{\string\XeTeXmathchar}{\meaning#1}}%
29 \reserved@a
```

If the symbol command definition contains `\XeTeXmathchar`, then we can provide the info that a previous symbol definition is being overwritten:

```
30 \ifin@
31 \expandafter\um@set@mathsymbol
32 \csname sym#3\endcsname#1#2{#4}%
33 \@font@info{Redefining math symbol \string#1}%
```

Otherwise, overwrite it if the symbol command definition contains plain old `\mathchar`:

```
34 \else
35 %\edef\reserved@a{\noexpand\in@{\string\mathchar}{\meaning#1}}%
36 %\reserved@a
37 %\ifin@
38 % \expandafter\set@xmathsymbol
39 % \csname sym#3\endcsname#1#2{#4}%
```

Otherwise, throw an error if the command name is already taken by a non-symbol definition:

```
40 %\else
41 %\expandafter\ifx
42 %\csname\expandafter\@gobble\string#1\endcsname
43 %\relax
44 \expandafter\um@set@mathsymbol
45 \csname sym#3\endcsname#1#2{#4}%
```

```

46         %\else
47         % \latex@error{Command '\string#1' already defined}\@eha
48         %\fi
49     %\fi
50 \fi

```

And if the symbol input is a character:

```

51     \else
52     \expandafter\um@set@mathchar
53     \csname sym#3\endcsname#1#2{#4}%
54     \fi
55 \endgroup

```

Everything previous was skipped if the maths font doesn't exist in the first place:

```

56 \else
57 \latex@error{Symbol font `#3' is not defined}\@eha
58 \fi}

```

The final macros that actually define the maths symbol with \XeTeX primitives.

```

\um@set@mathsymbol #1 : Symbol font number
                    #2 : Symbol macro, e.g., \alpha
                    #3 : Type, e.g., \mathalpha
                    #4 : Slot, e.g., "221E

```

If the symbol definition is for a macro. There are a bunch of tests to perform to process the various characters.

```

59 \def\um@set@mathsymbol#1#2#3#4{%
60   \iftrue%\unless\ifx#3\mathalpha

```

Operators First test if the character requires a `\nolimits` suffix. This is controlled by the `\um@nolimits` macro, which contains a commalist of such characters. If so, define the mathchar `\langle\mathbf{cs}\rangle` (where #2 is `\langle\mathbf{cs}\rangle`) and define `\langle\mathbf{cs}\rangle` as the wrapper around this control sequence.

```

61   \expandafter\in@\expandafter#2\expandafter{\um@nolimits}%
62   \ifin@
63     \expandafter\global\expandafter\XeTeXmathchardef
64     \csname\expandafter\@gobble\string#2 op\endcsname
65     =" \mathchar@type#3 #1 #4\relax
66     \gdef#2{\csname\expandafter\@gobble\string#2 op\endcsname\nolimits}%
67   \else

```

Radicals

```

68   \expandafter\in@\expandafter#2\expandafter{\um@radicals},}%
69   \ifin@
70     \gdef#2{\XeTeXradical#1 #4\relax}%
71   \else

```

Delimiters TODO: sort out which of these three declarations are necessary!

```

72     \ifx\mathopen#3\relax
73     \gdef#2{\XeTeXdelimiter "\mathchar@type#3 #1 #4}%
74     \global\XeTeXdelcode#4=#1 #4\relax
75     \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
76   \else
77     \ifx\mathclose#3\relax
78     \gdef#2{\XeTeXdelimiter "\mathchar@type#3 #1 #4}%
79     \global\XeTeXdelcode#4=#1 #4\relax
80     \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
81   \else

```

And finally, the general case. We define both the macro and the unicode math-code; this only works for 16-bit unicode scalar values, however. TODO: make all higher plane maths characters math-active so that spacing works for literal unicode input.

```

82     \global\XeTeXmathchardef#2="\mathchar@type#3 #1 #4\relax
83     \ifnum#4<"FFFF
84     \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
85   \fi
86 \fi
87 \fi
88 \fi
89 \fi
90 \fi}

```

`\um@set@mathchar` #1 : Symbol font number
 #2 : Symbol, e.g., `\alpha` or `a`
 #3 : Type, e.g., `\mathalpha`
 #4 : Slot, e.g., "221E
 Or if it's for a character:

```

91 \def\um@set@mathchar#1#2#3#4{%
92   \global\XeTeXmathcode`#2="\mathchar@type#3 #1 #4\relax}

```



```

\zf@fontspec{}\Cambria Math}
\let\glb@currsize\relax
\DeclareSymbolFont{test}{EU1}{\zf@family}{m}{n}
\DeclareUnicodeMathSymbol{\infty}{\mathord}{test}{"221E}
$\infty$

```

`\SetMathCode` [For later] or if it's for a character code (just a wrapper around the primitive). Note that this declaration *isn't* global so that it can be constrained by grouping.

```

93 \newcommand\SetMathCode[4]{%
94   \XeTeXmathcode#1=
95   "\mathchar@type#2 \csname sym#3\endcsname #4\relax}

```

A

```
\zf@fontspec{}\Cambria Math}
\let\glb@currsizel relax
\DeclareSymbolFont{test2}{EU1}{\zf@family}{m}{n}
\SetMathCode{65}{\mathalpha}{test2}{119860}
$A$
```

4.3 User interface to `\DeclareSymbolFont`

Here's the simplest usage:

$$Ax \stackrel{\text{def}}{=} \nabla \times Z$$

```
\setmathfont{Cambria Math}
$Ax \eqdef \nabla \times \text{scrZ}$
```

And an example of the Range feature:

$$(a, a, \mathbf{a}, \alpha, \aleph)$$

```
\setmathfont{Cambria Math}
$(a, \text{ita}, \mathbf{a}, \mathbf{a}, \alpha, \aleph)$
\setmathfont[Range={"2133-"2135, \alpha}]{Lucida Sans}
$(a, \text{ita}, \mathbf{a}, \mathbf{a}, \alpha, \aleph)$
```

$$(a, a, \mathbf{a}, \mathbf{a}, \square, \aleph)$$

A less useful (perhaps) example of the Range feature:

$$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t) dt$$

```
\setmathfont[Colour=000000]{Cambria Math}
\setmathfont[Range={\mathop}, Colour=FF0000]{Cambria Math}
\setmathfont[Range={\equal}, Colour=009900]{Cambria Math}
\setmathfont[Range={\mathopen, \mathclose},
  Colour=0000FF]{Cambria Math}
\[
F(s) = \text{scrL}\{f(t)\} = \int_0^\infty e^{-st} f(t) dt, \text{upd } t
\]
```

Using a Range including large character sets such as `\mathrel`, `\mathalpha`, etc., it *very slow*! I hope to improve the performance somehow.

`\setmathfont` [#1]: font features

#2 : font name

96 `\newcommand\setmathfont[2][]\%`

Init

- Erase any conception \LaTeX has of previously defined math symbol fonts; this allows `\DeclareSymbolFont` at any point in the document.
- To start with, assume we're defining every math symbol character.
- Bump up the `um@fam` counter to assign a new maths symbol font.

- Tell fontspec that maths font features are actually allowed.
- Grab the current size information (is this robust enough? Maybe it should be preceded by `\normalsize...`).
- Set the name of the math version being defined

```

97 \let\glb@currsizel\relax
98 \let\um@char@range\@empty
99 \let\um@char@num@range\@empty
100 \stepcounter{um@fam}%
101 \@um@fontspec@featuretrue
102 \csname S@\f@size\endcsname
103 \def\um@mversion{normal}%
104 \DeclareMathVersion{\um@mversion}%

```

Now when the list of unicode symbols is input, we want a suitable definition of its internal macro. By default, we want to define every single math char.

Use fontspec to select a font to use. The macro `\S@<size>` contains the definitions of the sizes used for maths letters, subscripts and subsubscripts in `\tf@size`, `\sf@size`, and `\ssf@size`, respectively.

Probably in the future we want options to change the hard-coded fontspec maths-related features.

```

105 \zf@fontspec{
106   Script=Math, SizeFeatures={
107     {Size=\tf@size-},
108     {Size=\sf@size-\tf@size,ScriptStyle={}},
109     {Size=-\sf@size,ScriptScriptStyle={}}},
110   #1}{#2}%

```

Probably want to check there that we're not creating multiple symbol fonts with the same NFSS declaration. On that note, fontspec doesn't seem to be keeping track of that, either :((check that out!)

```

111 \edef\um@symfont{um@fam\theum@fam}%
112 \DeclareSymbolFont{\um@symfont}
113   {\encodingdefault}{\zf@family}{\mddefault}{\updefault}%
114 \ifx\um@char@range\@empty
115   \um@PackageInfo{Defining the default maths font as '#2'}%
116   \let\UnicodeMathSymbol\um@mathsymbol@noparse
117 \else
118   \let\UnicodeMathSymbol\um@mathsymbol@parse
119 \fi

```

And now we input every single maths char. See File III for the source to `unicode-math.tex`.

```

120 \input unicode-math.tex
121 \input unicode-math-add.tex

```

```

122 \ifx\um@char@range\@empty
123   \let\um@mathbb\@empty
124   \let\um@mathbf\@empty
125   \let\um@mathfrak\@empty
126   \let\um@mathup\@empty
127   \let\um@mathscr\@empty
128   \let\um@mathsf\@empty
129   \let\um@mathsfitt\@empty
130   \let\um@mathtt\@empty
131   \let\um@mathbf\@empty
132   \let\um@mathbfitt\@empty
133   \let\um@mathbffrak\@empty
134   \let\um@mathbfscr\@empty
135   \let\um@mathbfsf\@empty
136   \let\um@mathbfsfitt\@empty
137   \let\MathAlphabetChar\um@mathmap@noparse
138 \else
139   \let\MathAlphabetChar\um@mathmap@parse
140 \fi

```

4.4 Maths alphabets' character mapping

We want it to be convenient for users to actually type in maths. The ASCII Latin characters should be used for italic maths, and the text Greek characters should be used for upright/italic (depending on preference) Greek, if desired.

Numbers, zero to nine (from U+30: DIGIT ZERO):

```

141 \ifx\um@char@range\@empty
142 \um@FOR @tempcnta = [0:9] {%
143   \SetMathCode
144     {\numexpr\the\@tempcnta+"30\relax}
145     {\mathalpha}{\um@symfont}
146     {\numexpr\the\@tempcnta+"30\relax}}%

```

Latin alphabet, uppercase and lowercase:

```

147 \um@FOR @tempcnta = [0:25] {%
148   \SetMathCode
149     {\numexpr\the\@tempcnta+`\A\relax}
150     {\mathalpha}{\um@symfont}
151     {\numexpr\the\@tempcnta+"1D434\relax}
152   \SetMathCode
153     {\numexpr\the\@tempcnta+`\a\relax}
154     {\mathalpha}{\um@symfont}
155     {\numexpr\the\@tempcnta+"1D44E\relax}}%

```

Filling a hole for 'h', which maps to U+210E: PLANCK CONSTANT instead of the expected U+1D455: MATHEMATICAL ITALIC SMALL H (which is not assigned on account of the overlap):

```
156 \SetMathCode{\h}{\mathalpha}{\um@symfont}{\l"210E}%
```

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

```
\setmathfont{Cambria Math}
$0123456789$ \l
$ABCDEFGHIJKLMNOPQRSTUVWXYZ$ \l
$abcdefghijklmnopqrstuvwxyz$ \l
```

Greek alphabet, italic uppercase and lowercase respectively:

```
157 \um@FOR @tempcnta = [0:23] {%
158   \SetMathCode
159     {\numexpr\the\@tempcnta+913\relax}
160     {\mathalpha}{\um@symfont}
161     {\numexpr\the\@tempcnta+"1D6E2\relax}
162   \SetMathCode
163     {\numexpr\the\@tempcnta+945\relax}
164     {\mathalpha}{\um@symfont}
165     {\numexpr\the\@tempcnta+"1D6FC\relax}}%
166 \fi
```

TODO: switches for upright Greek if desired.

ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ
αβγδεζηθικλμνξοπρστυφχψω

```
\setmathfont{Cambria Math}
$ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ$ \l
$αβγδεζηθικλμνξοπρστυφχψω$ \l
```

Set up the maths alphabets:

```
167 \input unicode-math-alphabets.tex
End of the \setmathfont macro.
168 }
```

`\um@mathsymbol@noparse`

```
169 \newcommand\um@mathsymbol@noparse[4]{
170   \DeclareUnicodeMathSymbol
171     {#2}{#3}{\um@symfont}{#1}}
```

`\um@mathsymbol@parse` If the Range font feature has been used, then only a subset of the unicode glyphs are to be defined. See section 5.2 for the code that enables this.

```
172 \newcommand\um@mathsymbol@parse[4]{
173   \um@parse@term{#1}{#2}{#3}{%
174     %\um@PackageInfo{Defining \string#2 as mathchar #1}%
175     \DeclareUnicodeMathSymbol
176       {#2}{#3}{\um@symfont}{#1}}
```

`\um@mk@alph` Wrapper to define maths alphabets.

```
177 \newcommand\um@mk@math[1]{%
178   \expandafter\def\csname math#1\endcsname##1{%
```

```

179 \begingroup
180 \csname um@math#1\endcsname
181 ##1
182 \endgroup}}

```

`\um@prep@math` Macro to set up mathcode mapping within maths alphabets.

```

183 \newcommand\um@prep@math[2]{}

```

Maths alphabets' base definition. See section 4.4 for the internal definitions.

```

184 \um@mk@math{up}
185 \um@mk@math{scr}
186 \um@mk@math{bb}
187 \um@mk@math{frak}
188 \um@mk@math{sf}
189 \um@mk@math{sfit}
190 \um@mk@math{tt}

```

And bold maths alphabets. See section 5.4 for the internal definitions.

```

191 \um@mk@math{bf}
192 \um@mk@math{bf it}
193 \um@mk@math{bfscr}
194 \um@mk@math{bffrak}
195 \um@mk@math{bfsf}
196 \um@mk@math{bfsfit}

```

`\mathcal`

```

197 \let\mathcal\mathscr

```

`\um@mathmap@noparse` #1 : Maths alphabet, *e.g.*, `\mathbb`

#2 : Input slot, *e.g.*, the slot for 'A'

#3 : Output slot, *e.g.*, the slot for 'A'

Adds `\SetMathCode` declarations to the specified maths alphabet's definition (*e.g.*, `\um@mathscr`). Uses `\um@addto@mathmap` (below) to expand the name of the current symbol font.

```

198 \newcommand\um@mathmap@noparse[3]{%
199 \expandafter\um@addto@mathmap\expandafter{\um@symfont}{#1}{#2}{#3}}%

```

`\um@mathmap@parse` #1 : Maths alphabet, *e.g.*, `\mathbb`

#2 : Input slot, *e.g.*, the slot for 'A'

#3 : Output slot, *e.g.*, the slot for 'A'

When `\um@parse@term` is executed, it populates the `\um@char@num@range` macro with slot numbers corresponding to the specified range. This range is used to conditionally add `\SetMathCode` declarations to the maths alphabet definition (*e.g.*, `\um@mathscr`).

```

200 \newcommand\um@mathmap@parse[3]{%
201 \@for\@ii:=\um@char@num@range\do{%

```

```

202 \ifnum\@i=#3\relax
203 \expandafter\um@addto@mathmap\expandafter{\um@symfont}{#1}{#2}{#3}%
204 \fi}}%

\um@addto@mathmap #1 : Math symbol font, always/usually the expansion of \um@symfont
#2 : Maths alphabet, e.g., \mathbb
#3 : Input slot, e.g., the slot for ‘A’
#4 : Output slot, e.g., the slot for ‘A’
This macro is used so that \um@symfont can be expanded before entering the
\g@addto@macro command.

205 \newcommand\um@addto@mathmap[4]{%
206 \expandafter\g@addto@macro\csname um@\expandafter\@gobble\string#2\endcsname{%
207 \SetMathCode{#3}{\mathalpha}{#1}{#4}}}
```

4.5 (Big) operators

Turns out that \XeTeX is clever enough to deal with big operators for us automatically with \XeTeXmathchardef . Amazing!

However, the limits aren’t set automatically; that is, we want to define, a la Plain \TeX *etc.*, $\text{\def\int{\intop\nolimits}}$, so there needs to be a transformation from \int to \intop during the expansion of $\text{\UnicodeMathSymbol}$ in the appropriate contexts.

TODO use \mathchar "8000 to create active operators that have \nolimits suffices.

Following is a table of every math operator (\mathop) defined in unicode-maths.tex , from which a subset need to be flagged for \nolimits adjustments. The limits as specified by unicode-math are shown (in grey).

`\um@nolimits` This macro is a commalist containing those maths operators that require a `\no-limits` suffix. This list is used when processing `unicode-math.tex` to define such commands automatically (see the macro `\um@set@mathsymbol` on page 7). I’ve chosen essentially just the operators that look like integrals; hopefully a better mathematician can help me out here. I’ve a feeling that it’s more useful *not* to include the multiple integrals such as \iiint , but that might be a matter of preference.

```

208 \def\um@nolimits{%
209   \int,\iint,\iiint,\iiint,\oint,\oint,\oiint,%
210   \intclockwise,\varointclockwise,\ointctrclockwise,%
211   \sumint,\intbar,\intBar,\fint,%
212   \cirfnint,\awint,\rppoint,\scpoint,\npoint,\pointint,\sqint,%
213   \intlarhk,\intx,\intcap,\intcup,\upint,\lowint}

```

`\addnolimits` This macro appends material to the macro containing the list of operators that don’t take limits. Items must be removed manually, at this stage; I’m working on a macro for this too, but it’s a bit harder!

```

214 \newcommand\addnolimits[1]{\g@addto@macro\um@nolimits{,#1}}

```

$$\int_0^1 \sum_0^N \left(\frac{\left(\sum_{i=n}^N \left(\int_0^1 (a \times b) \right) \right)}{A_{D_E}^{B^C}} \right)$$

```

\setmathfont{Cambria Math}
\[ \int_0^1 \sum_0^N \left( \frac{
\left( \sum_{i=n}^N \left( \int_0^1
\left( a \times b \right)
\right) \right) }{A^{B^C}_{D_E}} \right) \]

```

4.6 Radicals

The radical for square root is organised in `\um@set@mathsymbol` on page ?? . I think it’s the only radical ever. But what about right-to-left square roots?

`\um@radicals` We organise radicals in the same way as `nolimits`-operators; that is, in a commalist.

```

215 \def\um@radicals{\sqrt}

```

$$\sqrt{1 + \sqrt{1 + x}}$$

```
\setmathfont{Cambria Math}
\[\sqrt{1+\sqrt{1+x}}\]
```

4.7 Delimiters

`\left` We redefine the primitive to be preceded by `\mathopen`; this gives much better spacing in cases such as `\sin\left....` Courtesy of Frank Mittelbach:
<http://www.latex-project.org/cgi-bin/ltxbugs2html?pr=latex/3853&prlatex/3754>

```
216 \let\left@primitive\left
217 \def\left{\mathopen{}\left@primitive}
```

No re-definition is made for `\right` because I don't believe it to be necessary...
 TODO: 'fences', e.g., `\vert`

$$\left(\left(\left(\left(x^1\right)^2\right)^3\right)^4\right)^5$$

$$\left[\left[\left[\left[y^1\right]^2\right]^3\right]^4\right]^5$$

$$\left\{\left\{\left\{\left[z^1\right]^2\right]^3\right\}^4\right\}^5$$

```
\setmathfont{Cambria Math}
\[\left(\left(\left(\left(\left(x\right)^1\right)^2\right)^3\right)^4\right)^5\]
\[\left[\left[\left[\left(\left[y\right]^1\right)^2\right]^3\right]^4\right]^5\]
\[\left\{\left\{\left\{\left(\left[z\right]^1\right)^2\right)^3\right\}^4\right\}^5\]
```

Here are all `\mathopen` characters:

USV	Ex.	Macro	Description
U+00028	(<code>\lparen</code>	LEFT PARENTHESIS
U+0005B	[<code>\lbrack</code>	LEFT SQUARE BRACKET
U+0007B	{	<code>\lbrace</code>	LEFT CURLY BRACKET
U+000AB	«	<code>\guillemotleft</code>	DOUBLE ANGLE QUOTATION MARK (GUILLEMET), LEFT
U+002BB	‘	<code>\textturncomma</code>	QUOTE, SINGLE, LEFT
U+02018	‘	<code>\lq</code>	SINGLE QUOTATION MARK, LEFT
U+0201A	,	<code>\quotsinglbase</code>	RISING SINGLE QUOTE, LEFT (LOW)
U+0201C	“	<code>\textquotedblleft</code>	DOUBLE QUOTATION MARK, LEFT

U+0201E	”	\quotdblbase	RISING DOUBLE QUOTE, LEFT (LOW)
U+02039	<	\guilsinglleft	SINGLE ANGLE QUOTATION MARK (GUILLEMET), LEFT
U+0221A	√	\sqrt	RADICAL
U+02308	⌈	\lceil	LEFT CEILING
U+0230A	⌋	\lfloor	LEFT FLOOR
U+0231C	⌞	\ulcorner	UPPER LEFT CORNER
U+0231E	⏟	\llcorner	LOWER LEFT CORNER
U+02772	⌞	\lbrbrak	LIGHT LEFT TORTOISE SHELL BRACKET ORNAMENT
U+027C5	⏞	\lbag	LEFT S-SHAPED BAG DELIMITER
U+027E6	⌈	\lBrack	MATHEMATICAL LEFT WHITE SQUARE BRACKET
U+027E8	⌞	\langle	MATHEMATICAL LEFT ANGLE BRACKET
U+027EA	⌘	\lAngle	MATHEMATICAL LEFT DOUBLE ANGLE BRACKET
U+027EC	⌞	\Lbrbrak	MATHEMATICAL LEFT WHITE TORTOISE SHELL BRACKET
U+02983	⌈	\lBrace	LEFT WHITE CURLY BRACKET
U+02985	⌈	\lParen	LEFT WHITE PARENTHESIS
U+02987	⌈	\llparenthesis	Z NOTATION LEFT IMAGE BRACKET
U+02989	⌈	\llangle	Z NOTATION LEFT BINDING BRACKET
U+0298B	⌈	\lbrackubar	LEFT SQUARE BRACKET WITH UNDERBAR
U+0298D	⌈	\lbrackultick	LEFT SQUARE BRACKET WITH TICK IN TOP CORNER
U+0298F	⌈	\lbracklltick	LEFT SQUARE BRACKET WITH TICK IN BOTTOM CORNER
U+02991	⌞	\langledot	LEFT ANGLE BRACKET WITH DOT
U+02993	⌞	\lparenless	LEFT ARC LESS-THAN BRACKET
U+02997	⌞	\lblkbrbrak	LEFT BLACK TORTOISE SHELL BRACKET
U+029D8	⌘	\lvzigzag	LEFT WIGGLY FENCE
U+029DA	⌘	\Lvzigzag	LEFT DOUBLE WIGGLY FENCE
U+029FC	⌞	\lcurvyangle	LEFT POINTING CURVED ANGLE BRACKET
U+03014	⌞	\lbrbrak	LEFT BROKEN BRACKET
U+03018	⌞	\Lbrbrak	LEFT WHITE TORTOISE SHELL BRACKET

And \mathclose:

USV	Ex.	Macro	Description
U+00029)	\rparen	RIGHT PARENTHESIS
U+0005D]	\rbrack	RIGHT SQUARE BRACKET
U+0007D	}	\rbrace	RIGHT CURLY BRACKET

U+000BB	»	\guillemotright	DOUBLE ANGLE QUOTATION MARK (GUILLEMET), RIGHT
U+02019	'	\rq	SINGLE QUOTATION MARK, RIGHT
U+0201B	‘	\quotsinglright	RISING SINGLE QUOTE, RIGHT (HIGH)
U+0201D	”	\textquotedblright	DOUBLE QUOTATION MARK, RIGHT
U+0201F	“	\quotdblright	RISING DOUBLE QUOTE, RIGHT (HIGH)
U+0203A	›	\guilsinglright	SINGLE ANGLE QUOTATION MARK (GUILLEMET), RIGHT
U+02309	⌈	\rceil	RIGHT CEILING
U+0230B	⌋	\rfloor	RIGHT FLOOR
U+0231D	⌵	\urcorner	UPPER RIGHT CORNER
U+0231F	⌷	\lrcorner	LOWER RIGHT CORNER
U+02773	⌋	\rbrbrak	LIGHT RIGHT TORTOISE SHELL BRACKET ORNAMENT
U+027C6	⌋	\rbag	RIGHT S-SHAPED BAG DELIMITER
U+027E7	⌋	\rBrack	MATHEMATICAL RIGHT WHITE SQUARE BRACKET
U+027E9	⌋	\rangle	MATHEMATICAL RIGHT ANGLE BRACKET
U+027EB	⌋	\rAngle	MATHEMATICAL RIGHT DOUBLE ANGLE BRACKET
U+027ED	⌋	\Rbrbrak	MATHEMATICAL RIGHT WHITE TORTOISE SHELL BRACKET
U+02984	⌋	\rBrace	RIGHT WHITE CURLY BRACKET
U+02986)	\rParen	RIGHT WHITE PARENTHESIS
U+02988	⌋	\rrparenthesis	Z NOTATION RIGHT IMAGE BRACKET
U+0298A	⌋	\rrangle	Z NOTATION RIGHT BINDING BRACKET
U+0298C	⌋	\rbrackubar	RIGHT SQUARE BRACKET WITH UNDER-BAR
U+0298E	⌋	\rbracklrtick	RIGHT SQUARE BRACKET WITH TICK IN BOTTOM CORNER
U+02990	⌋	\rbrackurtick	RIGHT SQUARE BRACKET WITH TICK IN TOP CORNER
U+02992	⌋	\rangledot	RIGHT ANGLE BRACKET WITH DOT
U+02994	⌋	\rparengtr	RIGHT ARC GREATER-THAN BRACKET
U+02998)	\rblkbbrak	RIGHT BLACK TORTOISE SHELL BRACKET
U+029D9	⌋	\rvzigzag	RIGHT WIGGLY FENCE
U+029DB	⌋	\Rvzigzag	RIGHT DOUBLE WIGGLY FENCE
U+029FD	⌋	\rcurvyangle	RIGHT POINTING CURVED ANGLE BRACKET
U+03015	⌋	\rbrbrak	RIGHT BROKEN BRACKET
U+03019	⌋	\Rbrbrak	RIGHT WHITE TORTOISE SHELL BRACKET

4.8 Maths accents

TODO

5 fontspec feature hooks

`\um@zf@feature` Use the same method as `fontspec` for feature definition (*i.e.*, using `xkeyval`) but with a conditional to restrict the scope of these features to `unicode-math` commands.

```
218 \newcommand\um@zf@feature[2]{%
219   \define@key[zf]{options}{#1}{%
220     \if@um@fontspec@feature
221       #2
222     \else
223       \PackageError{fontspec/unicode-math}
224         {The '#1' font feature can only be used for maths fonts}
225         {The feature you tried to use can only be in commands
226          like \protect\setmathfont}%
227     \fi}}
```

5.1 OpenType maths font features

These aren't defined in `fontspec` because they aren't useful in non-maths contexts. (Actually, that might be a lie.)

```
228 \um@zf@feature{ScriptStyle}{%
229   \zf@update@ff{+ssty=0}}
230 \um@zf@feature{ScriptScriptStyle}{%
231   \zf@update@ff{+ssty=1}}
```

5.2 Range processing

```
232 \um@zf@feature{Range}{\xdef\um@char@range{\zap@space#1 \@empty}}
```

Pretty basic comma separated range processing. Donald Arseneau's `selectp` package has a cleverer technique.

`\um@parse@term` #1 : unicode character slot
#2 : control sequence (character macro)
#3 : control sequence (math type)
#4 : code to execute

This macro expands to #4 (Unless I've got my terminology twisted again.) if any of its arguments are contained in the commalist `\um@char@range`. This list can contain either character ranges (for checking with #1) or control sequences. These latter can either be the command name of a specific character, *or* the math type of one (*e.g.*, `\mathbin`).

Character ranges are passed to `\um@parse@range`, which accepts input in the form shown in table 4.

Input	Range
x	$r = x$
$x-$	$r \geq x$
$-y$	$r \leq y$
$x-y$	$x \leq r \leq y$

Table 4: Ranges accepted by `\um@parse@range`

Start by iterating over the commalist, ignoring empties, and initialising the scratch conditional:

```

233 \newcommand\um@parse@term[4]{%
234   \@for\@ii:=\um@char@range\do{%
235     \unless\ifx\@ii\@empty
236       \@tempswafalse

```

`\if\relax\noexpand##` is true if `##` is a control sequence; then match to either the character macro (`\alpha`) or the math type (`\mathbin`):

```

237     \expandafter\if\expandafter\relax\expandafter\noexpand\@ii
238     \expandafter\ifx\@ii#2
239       \@tempswatrue
240     \else
241       \expandafter\ifx\@ii#3
242       \@tempswatrue
243     \fi
244   \fi

```

Otherwise, we have a number range, which is passed to another macro:

```

245   \else
246     \expandafter\um@parse@range\@ii-\@marker-\@nil#1\@nil
247   \fi

```

If we have a match, execute the code! It also populates the `\um@char@num@range` macro, which is used when defining `\mathbf` (*etc.*) `\mathchar` remappings.

```

248   \if@tempswa
249     \ifx\um@char@num@range\@empty
250       \g@addto@macro\um@char@num@range{#1}%
251     \else
252       \g@addto@macro\um@char@num@range{,#1}%
253     \fi
254   #4
255   \fi
256 \fi}}

```

'1' or '\a' or '\b' is included '1' or '\b' or '\c'
 is included '3' or '\a' or '\b' is included '3' or
 '\a' or '\b' is included

```
\def\um@char@range{\a,2-4,\c}
\um@parse@term{1}{\a}{\b}
  {\a' or '\string'a' or '\string\b' is included}
\um@parse@term{1}{\b}{\c}
  {\b' or '\string\b' or '\string\c' is included}
\um@parse@term{3}{\a}{\b}
  {\a' or '\string'a' or '\string\b' is included}
```

\um@parse@range Weird syntax. As shown previously in table 4, this macro can be passed four different input types via \um@parse@term.

```
257 \def\um@parse@range#1-#2-#3\@nil#4\@nil{%
258   \def\@tempa{#1}%
259   \def\@tempb{#2}%
Range      r = x
C-list input \@ii=X
Macro input \um@parse@range X-\@marker-\@nil#1\@nil
Arguments  #1-#2-#3 = X-\@marker-{} 
260   \ifx\@marker\@tempb\relax
261     \ifnum#4=#1\relax
262       \@tempswatrue
263     \fi
264   \else
Range      r ≥ x
C-list input \@ii=X-
Macro input \um@parse@range X--\@marker-\@nil#1\@nil
Arguments  #1-#2-#3 = X-{}-\@marker-
265   \ifx\@empty\@tempb
266     \ifnum#4>\numexpr#1-1\relax
267       \@tempswatrue
268     \fi
269   \else
Range      r ≤ y
C-list input \@ii=-Y
Macro input \um@parse@range -Y-\@marker-\@nil#1\@nil
Arguments  #1-#2-#3 = {}-Y-\@marker-
270   \ifx\@empty\@tempa
271     \ifnum#4<\numexpr#2+1\relax
272       \@tempswatrue
273     \fi
Range      x ≤ r ≤ y
C-list input \@ii=X-Y
Macro input \um@parse@range X-Y-\@marker-\@nil#1\@nil
Arguments  #1-#2-#3 = X-Y-\@marker-
```

```

274     \else
275     \ifnum#4>\numexpr#1-1\relax
276     \ifnum#4<\numexpr#2+1\relax
277     \@tempswattrue
278     \fi
279     \fi
280     \fi
281     \fi
282 \fi}

```

5.3 Resolving Greek letters

TODO add switch for upright if desired.

```

283 \AtBeginDocument{\def\Alpha{\itAlpha}
284 \def\Beta{\itBeta}
285 \def\Gamma{\itGamma}
286 \def\Delta{\itDelta}
287 \def\Epsilon{\itEpsilon}
288 \def\Zeta{\itZeta}
289 \def\Eta{\itEta}
290 \def\Theta{\itTheta}
291 \def\Iota{\itIota}
292 \def\Kappa{\itKappa}
293 \def\Lambda{\itLambda}
294 \def\Mu{\itMu}
295 \def\Nu{\itNu}
296 \def\Xi{\itXi}
297 \def\Omicron{\itOmicron}
298 \def\Pi{\itPi}
299 \def\Rho{\itRho}
300 \def\varTheta{\itvarTheta}
301 \def\Sigma{\itSigma}
302 \def\Tau{\itTau}
303 \def\Upsilon{\itUpsilon}
304 \def\Phi{\itPhi}
305 \def\Chi{\itChi}
306 \def\Psi{\itPsi}
307 \def\Omega{\itOmega}
308 \def\nabla{\itnabla}
309 \def\alpha{\italpha}
310 \def\beta{\itbeta}
311 \def\gamma{\itgamma}
312 \def\delta{\itdelta}
313 \def\varepsilon{\itvarepsilon}
314 \def\zeta{\itzeta}
315 \def\eta{\iteta}

```

```

316 \def\theta{\ittheta}
317 \def\iota{\itiota}
318 \def\kappa{\itkappa}
319 \def\lambda{\itlambda}
320 \def\mu{\itmu}
321 \def\nu{\itnu}
322 \def\xi{\itxi}
323 \def\omicron{\itomicron}
324 \def\pi{\itpi}
325 \def\rho{\itrho}
326 \def\varsigma{\itvarsigma}
327 \def\sigma{\itsigma}
328 \def\tau{\ittau}
329 \def\upsilon{\itupsilon}
330 \def\phi{\itphi}
331 \def\chi{\itchi}
332 \def\psi{\itpsi}
333 \def\omega{\itomega}
334 \def\partial{\uppartial}
335 \def\varepsilon{\itvarepsilon}
336 \def\vartheta{\itvartheta}
337 \def\varkappa{\itvarkappa}
338 \def\varphi{\itvarphi}
339 \def\varrho{\itvarrho}
340 \def\varpi{\itvarpi}}

```

TODO: digamma

File II

Maths alphabets mapping definitions

TODO: everything

5.3.1 Upright: `\mathup`

Can't call it `\mathrm` any more because it contains Greek as well!

ABCDEFGHIJKLMNOPQRSTUVWXYZ	<code>\setmathfont{Cambria Math}</code>
abcdefghijklmnopqrstuvwxyz	<code>\$\mathup{ABCDEFGHIJKLMNOPQRSTUVWXYZ}\$ \\</code>
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ	<code>\$\mathup{abcdefghijklmnopqrstuvwxyz}\$ \\</code>
αβγδεζηθικλμνξοπρστυφχψω	<code>\$\mathup{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}\$ \\</code>

Roman uppercase:

```
1 \MathAlphabetChar{\mathup}{`A}{`A}%
2 \MathAlphabetChar{\mathup}{`B}{`B}%
3 \MathAlphabetChar{\mathup}{`C}{`C}%
4 \MathAlphabetChar{\mathup}{`D}{`D}%
5 \MathAlphabetChar{\mathup}{`E}{`E}%
6 \MathAlphabetChar{\mathup}{`F}{`F}%
7 \MathAlphabetChar{\mathup}{`G}{`G}%
8 \MathAlphabetChar{\mathup}{`H}{`H}%
9 \MathAlphabetChar{\mathup}{`I}{`I}%
10 \MathAlphabetChar{\mathup}{`J}{`J}%
11 \MathAlphabetChar{\mathup}{`K}{`K}%
12 \MathAlphabetChar{\mathup}{`L}{`L}%
13 \MathAlphabetChar{\mathup}{`M}{`M}%
14 \MathAlphabetChar{\mathup}{`N}{`N}%
15 \MathAlphabetChar{\mathup}{`O}{`O}%
16 \MathAlphabetChar{\mathup}{`P}{`P}%
17 \MathAlphabetChar{\mathup}{`Q}{`Q}%
18 \MathAlphabetChar{\mathup}{`R}{`R}%
19 \MathAlphabetChar{\mathup}{`S}{`S}%
20 \MathAlphabetChar{\mathup}{`T}{`T}%
21 \MathAlphabetChar{\mathup}{`U}{`U}%
22 \MathAlphabetChar{\mathup}{`V}{`V}%
23 \MathAlphabetChar{\mathup}{`W}{`W}%
24 \MathAlphabetChar{\mathup}{`X}{`X}%
25 \MathAlphabetChar{\mathup}{`Y}{`Y}%
26 \MathAlphabetChar{\mathup}{`Z}{`Z}%
```

Roman lowercase:

```
27 \MathAlphabetChar{\mathup}{`a}{`a}%
28 \MathAlphabetChar{\mathup}{`b}{`b}%
29 \MathAlphabetChar{\mathup}{`c}{`c}%
30 \MathAlphabetChar{\mathup}{`d}{`d}%
31 \MathAlphabetChar{\mathup}{`e}{`e}%
32 \MathAlphabetChar{\mathup}{`f}{`f}%
33 \MathAlphabetChar{\mathup}{`g}{`g}%
34 \MathAlphabetChar{\mathup}{`h}{`h}%
35 \MathAlphabetChar{\mathup}{`i}{`i}%
36 \MathAlphabetChar{\mathup}{`j}{`j}%
37 \MathAlphabetChar{\mathup}{`k}{`k}%
38 \MathAlphabetChar{\mathup}{`l}{`l}%
39 \MathAlphabetChar{\mathup}{`m}{`m}%
40 \MathAlphabetChar{\mathup}{`n}{`n}%
41 \MathAlphabetChar{\mathup}{`o}{`o}%
42 \MathAlphabetChar{\mathup}{`p}{`p}%
43 \MathAlphabetChar{\mathup}{`q}{`q}%
44 \MathAlphabetChar{\mathup}{`r}{`r}%
```


\mathcal{S}
 \mathcal{T}
 \mathcal{U}
 \mathcal{V}
 \mathcal{W}
 \mathcal{X}
 \mathcal{Y}
 \mathcal{Z}

Greek uppercase:

\mathcal{A}
 \mathcal{B}
 \mathcal{C}
 \mathcal{D}
 \mathcal{E}
 \mathcal{F}
 \mathcal{G}
 \mathcal{H}
 \mathcal{I}
 \mathcal{K}
 \mathcal{L}
 \mathcal{M}
 \mathcal{N}
 \mathcal{O}
 \mathcal{P}
 \mathcal{Q}
 \mathcal{R}
 \mathcal{S}
 \mathcal{T}
 \mathcal{U}
 \mathcal{V}
 \mathcal{W}
 \mathcal{X}
 \mathcal{Y}
 \mathcal{Z}

Greek lowercase:

\mathcal{a}
 \mathcal{b}
 \mathcal{c}
 \mathcal{d}
 \mathcal{e}
 \mathcal{f}
 \mathcal{g}
 \mathcal{h}
 \mathcal{i}
 \mathcal{k}
 \mathcal{l}
 \mathcal{m}
 \mathcal{n}
 \mathcal{o}
 \mathcal{p}
 \mathcal{q}
 \mathcal{r}
 \mathcal{s}
 \mathcal{t}
 \mathcal{u}
 \mathcal{v}
 \mathcal{w}
 \mathcal{x}
 \mathcal{y}
 \mathcal{z}

```

89 \MathAlphabetChar{\mathup}{957}{957}%
90 \MathAlphabetChar{\mathup}{958}{958}%
91 \MathAlphabetChar{\mathup}{959}{959}%
92 \MathAlphabetChar{\mathup}{960}{960}%
93 \MathAlphabetChar{\mathup}{961}{961}%
94 \MathAlphabetChar{\mathup}{962}{962}%
95 \MathAlphabetChar{\mathup}{963}{963}%
96 \MathAlphabetChar{\mathup}{964}{964}%
97 \MathAlphabetChar{\mathup}{965}{965}%
98 \MathAlphabetChar{\mathup}{966}{966}%
99 \MathAlphabetChar{\mathup}{967}{967}%
100 \MathAlphabetChar{\mathup}{968}{968}%

```

TODO: nabla and others

5.3.2 Blackboard or double-struck: `\mathbb`

0123456789	<code>\setmathfont{Cambria Math}</code>
ABCDEFGHIJKLMN O PQRSTU VWXYZ	<code>\$\mathbb{0123456789}\$ \</code>
abcdefghijklmnopqrstuvwxyz	<code>\$\mathbb{ABCDEFGHIJKLMN O PQRSTU VWXYZ}\$ \</code>
	<code>\$\mathbb{abcdefghijklmnopqrstuvwxyz}\$ \</code>

Numbers: (always upright)

```

101 \MathAlphabetChar{\mathbb}{`\0}{"1D7D8}%
102 \MathAlphabetChar{\mathbb}{`\1}{"1D7D9}%
103 \MathAlphabetChar{\mathbb}{`\2}{"1D7DA}%
104 \MathAlphabetChar{\mathbb}{`\3}{"1D7DB}%
105 \MathAlphabetChar{\mathbb}{`\4}{"1D7DC}%
106 \MathAlphabetChar{\mathbb}{`\5}{"1D7DD}%
107 \MathAlphabetChar{\mathbb}{`\6}{"1D7DE}%
108 \MathAlphabetChar{\mathbb}{`\7}{"1D7DF}%
109 \MathAlphabetChar{\mathbb}{`\8}{"1D7E0}%
110 \MathAlphabetChar{\mathbb}{`\9}{"1D7E1}%

```

Letters:

```

111 \MathAlphabetChar{\mathbb}{`\A}{"1D538}%
112 \MathAlphabetChar{\mathbb}{`\B}{"1D539}%
113 \MathAlphabetChar{\mathbb}{`\C}{"2102}%
114 \MathAlphabetChar{\mathbb}{`\D}{"1D53B}%
115 \MathAlphabetChar{\mathbb}{`\E}{"1D53C}%
116 \MathAlphabetChar{\mathbb}{`\F}{"1D53D}%
117 \MathAlphabetChar{\mathbb}{`\G}{"1D53E}%
118 \MathAlphabetChar{\mathbb}{`\H}{"210D}%
119 \MathAlphabetChar{\mathbb}{`\I}{"1D540}%
120 \MathAlphabetChar{\mathbb}{`\J}{"1D541}%
121 \MathAlphabetChar{\mathbb}{`\K}{"1D542}%

```

122 \MathAlphabetChar{\mathbb}{`L}{1D543}%
 123 \MathAlphabetChar{\mathbb}{`M}{1D544}%
 124 \MathAlphabetChar{\mathbb}{`N}{2115}%
 125 \MathAlphabetChar{\mathbb}{`O}{1D546}%
 126 \MathAlphabetChar{\mathbb}{`P}{2119}%
 127 \MathAlphabetChar{\mathbb}{`Q}{211A}%
 128 \MathAlphabetChar{\mathbb}{`R}{211D}%
 129 \MathAlphabetChar{\mathbb}{`S}{1D54A}%
 130 \MathAlphabetChar{\mathbb}{`T}{1D54B}%
 131 \MathAlphabetChar{\mathbb}{`U}{1D54C}%
 132 \MathAlphabetChar{\mathbb}{`V}{1D54D}%
 133 \MathAlphabetChar{\mathbb}{`W}{1D54E}%
 134 \MathAlphabetChar{\mathbb}{`X}{1D54F}%
 135 \MathAlphabetChar{\mathbb}{`Y}{1D550}%
 136 \MathAlphabetChar{\mathbb}{`Z}{2124}%

Roman lowercase:

137 \MathAlphabetChar{\mathbb}{`a}{1D552}%
 138 \MathAlphabetChar{\mathbb}{`b}{1D553}%
 139 \MathAlphabetChar{\mathbb}{`c}{1D554}%
 140 \MathAlphabetChar{\mathbb}{`d}{1D555}%
 141 \MathAlphabetChar{\mathbb}{`e}{1D556}%
 142 \MathAlphabetChar{\mathbb}{`f}{1D557}%
 143 \MathAlphabetChar{\mathbb}{`g}{1D558}%
 144 \MathAlphabetChar{\mathbb}{`h}{1D559}%
 145 \MathAlphabetChar{\mathbb}{`i}{1D55A}%
 146 \MathAlphabetChar{\mathbb}{`j}{1D55B}%
 147 \MathAlphabetChar{\mathbb}{`k}{1D55C}%
 148 \MathAlphabetChar{\mathbb}{`l}{1D55D}%
 149 \MathAlphabetChar{\mathbb}{`m}{1D55E}%
 150 \MathAlphabetChar{\mathbb}{`n}{1D55F}%
 151 \MathAlphabetChar{\mathbb}{`o}{1D560}%
 152 \MathAlphabetChar{\mathbb}{`p}{1D561}%
 153 \MathAlphabetChar{\mathbb}{`q}{1D562}%
 154 \MathAlphabetChar{\mathbb}{`r}{1D563}%
 155 \MathAlphabetChar{\mathbb}{`s}{1D564}%
 156 \MathAlphabetChar{\mathbb}{`t}{1D565}%
 157 \MathAlphabetChar{\mathbb}{`u}{1D566}%
 158 \MathAlphabetChar{\mathbb}{`v}{1D567}%
 159 \MathAlphabetChar{\mathbb}{`w}{1D568}%
 160 \MathAlphabetChar{\mathbb}{`x}{1D569}%
 161 \MathAlphabetChar{\mathbb}{`y}{1D56A}%
 162 \MathAlphabetChar{\mathbb}{`z}{1D56B}%

TODO: some Greek letters and symbols.

5.3.3 Script or caligraphic: `\mathscr` and `\mathcal`

`\mathcal` and `\mathscr` are aliases.

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

```
\setmathfont{Cambria Math}
$\mathscr{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathscr{abcdefghijklmnopqrstuvwxyz}$ \\
```

```
163 \MathAlphabetChar{\mathscr}{`A}{1D49C}%
164 \MathAlphabetChar{\mathscr}{`B}{8492}%
165 \MathAlphabetChar{\mathscr}{`C}{119966}%
166 \MathAlphabetChar{\mathscr}{`D}{119967}%
167 \MathAlphabetChar{\mathscr}{`E}{8496}%
168 \MathAlphabetChar{\mathscr}{`F}{8497}%
169 \MathAlphabetChar{\mathscr}{`G}{119970}%
170 \MathAlphabetChar{\mathscr}{`H}{8459}%
171 \MathAlphabetChar{\mathscr}{`I}{8464}%
172 \MathAlphabetChar{\mathscr}{`J}{119973}%
173 \MathAlphabetChar{\mathscr}{`K}{119974}%
174 \MathAlphabetChar{\mathscr}{`L}{8466}%
175 \MathAlphabetChar{\mathscr}{`M}{8499}%
176 \MathAlphabetChar{\mathscr}{`N}{119977}%
177 \MathAlphabetChar{\mathscr}{`O}{119978}%
178 \MathAlphabetChar{\mathscr}{`P}{119979}%
179 \MathAlphabetChar{\mathscr}{`Q}{119980}%
180 \MathAlphabetChar{\mathscr}{`R}{8475}%
181 \MathAlphabetChar{\mathscr}{`S}{119982}%
182 \MathAlphabetChar{\mathscr}{`T}{119983}%
183 \MathAlphabetChar{\mathscr}{`U}{119984}%
184 \MathAlphabetChar{\mathscr}{`V}{119985}%
185 \MathAlphabetChar{\mathscr}{`W}{119986}%
186 \MathAlphabetChar{\mathscr}{`X}{119987}%
187 \MathAlphabetChar{\mathscr}{`Y}{119988}%
188 \MathAlphabetChar{\mathscr}{`Z}{119989}%

189 \MathAlphabetChar{\mathscr}{`a}{1D4B6}%
190 \MathAlphabetChar{\mathscr}{`b}{1D4B7}%
191 \MathAlphabetChar{\mathscr}{`c}{1D4B8}%
192 \MathAlphabetChar{\mathscr}{`d}{1D4B9}%
193 \MathAlphabetChar{\mathscr}{`e}{212F}%
194 \MathAlphabetChar{\mathscr}{`f}{1D4BB}%
195 \MathAlphabetChar{\mathscr}{`g}{210A}%
196 \MathAlphabetChar{\mathscr}{`h}{1D4BD}%
197 \MathAlphabetChar{\mathscr}{`i}{1D4BE}%
198 \MathAlphabetChar{\mathscr}{`j}{1D4BF}%
199 \MathAlphabetChar{\mathscr}{`k}{1D4C0}%
200 \MathAlphabetChar{\mathscr}{`l}{1D4C1}%
```

```

201 \MathAlphabetChar{\mathscr}{`m}{1D4C2}%
202 \MathAlphabetChar{\mathscr}{`n}{1D4C3}%
203 \MathAlphabetChar{\mathscr}{`o}{2134}%
204 \MathAlphabetChar{\mathscr}{`p}{1D4C5}%
205 \MathAlphabetChar{\mathscr}{`q}{1D4C6}%
206 \MathAlphabetChar{\mathscr}{`r}{1D4C7}%
207 \MathAlphabetChar{\mathscr}{`s}{1D4C8}%
208 \MathAlphabetChar{\mathscr}{`t}{1D4C9}%
209 \MathAlphabetChar{\mathscr}{`u}{1D4CA}%
210 \MathAlphabetChar{\mathscr}{`v}{1D4CB}%
211 \MathAlphabetChar{\mathscr}{`w}{1D4CC}%
212 \MathAlphabetChar{\mathscr}{`x}{1D4CD}%
213 \MathAlphabetChar{\mathscr}{`y}{1D4CE}%
214 \MathAlphabetChar{\mathscr}{`z}{1D4CF}%

```

5.3.4 Fraktur or fraktur or blackletter: `\mathfrak`

$\mathfrak{A}\mathfrak{B}\mathfrak{C}\mathfrak{D}\mathfrak{E}\mathfrak{F}\mathfrak{G}\mathfrak{H}\mathfrak{I}\mathfrak{J}\mathfrak{K}\mathfrak{L}\mathfrak{M}\mathfrak{N}\mathfrak{O}\mathfrak{P}\mathfrak{Q}\mathfrak{R}\mathfrak{S}\mathfrak{T}\mathfrak{U}\mathfrak{V}\mathfrak{W}\mathfrak{X}\mathfrak{Y}\mathfrak{Z}$
 $\mathfrak{a}\mathfrak{b}\mathfrak{c}\mathfrak{d}\mathfrak{e}\mathfrak{f}\mathfrak{g}\mathfrak{h}\mathfrak{i}\mathfrak{j}\mathfrak{k}\mathfrak{l}\mathfrak{m}\mathfrak{n}\mathfrak{o}\mathfrak{p}\mathfrak{q}\mathfrak{r}\mathfrak{s}\mathfrak{t}\mathfrak{u}\mathfrak{v}\mathfrak{w}\mathfrak{x}\mathfrak{y}\mathfrak{z}$

```

\setmathfont{Cambria Math}
$\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathfrak{abcdefghijklmnopqrstuvwxyz}$ \\

```

Letters, with exceptions { \mathfrak{C} , \mathfrak{S} , \mathfrak{Z} , \mathfrak{R} , \mathfrak{J} }:

```

215 \MathAlphabetChar{\mathfrak}{`A}{1D504}%
216 \MathAlphabetChar{\mathfrak}{`B}{1D505}%
217 \MathAlphabetChar{\mathfrak}{`C}{212D}%
218 \MathAlphabetChar{\mathfrak}{`D}{1D507}%
219 \MathAlphabetChar{\mathfrak}{`E}{1D508}%
220 \MathAlphabetChar{\mathfrak}{`F}{1D509}%
221 \MathAlphabetChar{\mathfrak}{`G}{1D50A}%
222 \MathAlphabetChar{\mathfrak}{`H}{210C}%
223 \MathAlphabetChar{\mathfrak}{`I}{2111}%
224 \MathAlphabetChar{\mathfrak}{`J}{1D50D}%
225 \MathAlphabetChar{\mathfrak}{`K}{1D50E}%
226 \MathAlphabetChar{\mathfrak}{`L}{1D50F}%
227 \MathAlphabetChar{\mathfrak}{`M}{1D510}%
228 \MathAlphabetChar{\mathfrak}{`N}{1D511}%
229 \MathAlphabetChar{\mathfrak}{`O}{1D512}%
230 \MathAlphabetChar{\mathfrak}{`P}{1D513}%
231 \MathAlphabetChar{\mathfrak}{`Q}{1D514}%
232 \MathAlphabetChar{\mathfrak}{`R}{211C}%
233 \MathAlphabetChar{\mathfrak}{`S}{1D516}%
234 \MathAlphabetChar{\mathfrak}{`T}{1D517}%
235 \MathAlphabetChar{\mathfrak}{`U}{1D518}%
236 \MathAlphabetChar{\mathfrak}{`V}{1D519}%
237 \MathAlphabetChar{\mathfrak}{`W}{1D51A}%

```

```

238 \MathAlphabetChar{\mathfrak}{`X}{1D51B}%
239 \MathAlphabetChar{\mathfrak}{`Y}{1D51C}%
240 \MathAlphabetChar{\mathfrak}{`Z}{2128}%

241 \MathAlphabetChar{\mathfrak}{`a}{1D51E}%
242 \MathAlphabetChar{\mathfrak}{`b}{1D51F}%
243 \MathAlphabetChar{\mathfrak}{`c}{1D520}%
244 \MathAlphabetChar{\mathfrak}{`d}{1D521}%
245 \MathAlphabetChar{\mathfrak}{`e}{1D522}%
246 \MathAlphabetChar{\mathfrak}{`f}{1D523}%
247 \MathAlphabetChar{\mathfrak}{`g}{1D524}%
248 \MathAlphabetChar{\mathfrak}{`h}{1D525}%
249 \MathAlphabetChar{\mathfrak}{`i}{1D526}%
250 \MathAlphabetChar{\mathfrak}{`j}{1D527}%
251 \MathAlphabetChar{\mathfrak}{`k}{1D528}%
252 \MathAlphabetChar{\mathfrak}{`l}{1D529}%
253 \MathAlphabetChar{\mathfrak}{`m}{1D52A}%
254 \MathAlphabetChar{\mathfrak}{`n}{1D52B}%
255 \MathAlphabetChar{\mathfrak}{`o}{1D52C}%
256 \MathAlphabetChar{\mathfrak}{`p}{1D52D}%
257 \MathAlphabetChar{\mathfrak}{`q}{1D52E}%
258 \MathAlphabetChar{\mathfrak}{`r}{1D52F}%
259 \MathAlphabetChar{\mathfrak}{`s}{1D530}%
260 \MathAlphabetChar{\mathfrak}{`t}{1D531}%
261 \MathAlphabetChar{\mathfrak}{`u}{1D532}%
262 \MathAlphabetChar{\mathfrak}{`v}{1D533}%
263 \MathAlphabetChar{\mathfrak}{`w}{1D534}%
264 \MathAlphabetChar{\mathfrak}{`x}{1D535}%
265 \MathAlphabetChar{\mathfrak}{`y}{1D536}%
266 \MathAlphabetChar{\mathfrak}{`z}{1D537}%

```

5.3.5 Sans serif: `\mathsf`

0123456789	<code>\setmathfont{Cambria Math}</code>
ABCDEFGHIJKLMN O PQRSTU VWXYZ	<code>\$\mathsf{0123456789}\$ \</code>
abcdefghijklmnopqrstuvwxyz	<code>\$\mathsf{ABCDEFGHIJKLMN O PQRSTU VWXYZ}\$ \</code>
	<code>\$\mathsf{abcdefghijklmnopqrstuvwxyz}\$ \</code>

Numbers:

```

267 \MathAlphabetChar{\mathsf}{`\0}{1D7E2}%
268 \MathAlphabetChar{\mathsf}{`\1}{1D7E3}%
269 \MathAlphabetChar{\mathsf}{`\2}{1D7E4}%
270 \MathAlphabetChar{\mathsf}{`\3}{1D7E5}%
271 \MathAlphabetChar{\mathsf}{`\4}{1D7E6}%
272 \MathAlphabetChar{\mathsf}{`\5}{1D7E7}%
273 \MathAlphabetChar{\mathsf}{`\6}{1D7E8}%
274 \MathAlphabetChar{\mathsf}{`\7}{1D7E9}%

```

275 \MathAlphabetChar{\mathsf}{`\8}{1D7EA}%
 276 \MathAlphabetChar{\mathsf}{`\9}{1D7EB}%

Roman letters:

277 \MathAlphabetChar{\mathsf}{`\A}{1D5A0}%
 278 \MathAlphabetChar{\mathsf}{`\B}{1D5A1}%
 279 \MathAlphabetChar{\mathsf}{`\C}{1D5A2}%
 280 \MathAlphabetChar{\mathsf}{`\D}{1D5A3}%
 281 \MathAlphabetChar{\mathsf}{`\E}{1D5A4}%
 282 \MathAlphabetChar{\mathsf}{`\F}{1D5A5}%
 283 \MathAlphabetChar{\mathsf}{`\G}{1D5A6}%
 284 \MathAlphabetChar{\mathsf}{`\H}{1D5A7}%
 285 \MathAlphabetChar{\mathsf}{`\I}{1D5A8}%
 286 \MathAlphabetChar{\mathsf}{`\J}{1D5A9}%
 287 \MathAlphabetChar{\mathsf}{`\K}{1D5AA}%
 288 \MathAlphabetChar{\mathsf}{`\L}{1D5AB}%
 289 \MathAlphabetChar{\mathsf}{`\M}{1D5AC}%
 290 \MathAlphabetChar{\mathsf}{`\N}{1D5AD}%
 291 \MathAlphabetChar{\mathsf}{`\O}{1D5AE}%
 292 \MathAlphabetChar{\mathsf}{`\P}{1D5AF}%
 293 \MathAlphabetChar{\mathsf}{`\Q}{1D5B0}%
 294 \MathAlphabetChar{\mathsf}{`\R}{1D5B1}%
 295 \MathAlphabetChar{\mathsf}{`\S}{1D5B2}%
 296 \MathAlphabetChar{\mathsf}{`\T}{1D5B3}%
 297 \MathAlphabetChar{\mathsf}{`\U}{1D5B4}%
 298 \MathAlphabetChar{\mathsf}{`\V}{1D5B5}%
 299 \MathAlphabetChar{\mathsf}{`\W}{1D5B6}%
 300 \MathAlphabetChar{\mathsf}{`\X}{1D5B7}%
 301 \MathAlphabetChar{\mathsf}{`\Y}{1D5B8}%
 302 \MathAlphabetChar{\mathsf}{`\Z}{1D5B9}%
 303 \MathAlphabetChar{\mathsf}{`\a}{1D5BA}%
 304 \MathAlphabetChar{\mathsf}{`\b}{1D5BB}%
 305 \MathAlphabetChar{\mathsf}{`\c}{1D5BC}%
 306 \MathAlphabetChar{\mathsf}{`\d}{1D5BD}%
 307 \MathAlphabetChar{\mathsf}{`\e}{1D5BE}%
 308 \MathAlphabetChar{\mathsf}{`\f}{1D5BF}%
 309 \MathAlphabetChar{\mathsf}{`\g}{1D5C0}%
 310 \MathAlphabetChar{\mathsf}{`\h}{1D5C1}%
 311 \MathAlphabetChar{\mathsf}{`\i}{1D5C2}%
 312 \MathAlphabetChar{\mathsf}{`\j}{1D5C3}%
 313 \MathAlphabetChar{\mathsf}{`\k}{1D5C4}%
 314 \MathAlphabetChar{\mathsf}{`\l}{1D5C5}%
 315 \MathAlphabetChar{\mathsf}{`\m}{1D5C6}%
 316 \MathAlphabetChar{\mathsf}{`\n}{1D5C7}%
 317 \MathAlphabetChar{\mathsf}{`\o}{1D5C8}%
 318 \MathAlphabetChar{\mathsf}{`\p}{1D5C9}%
 319 \MathAlphabetChar{\mathsf}{`\q}{1D5CA}%

```

320 \MathAlphabetChar{\mathsf}{`\r}{"1D5CB}%
321 \MathAlphabetChar{\mathsf}{`\s}{"1D5CC}%
322 \MathAlphabetChar{\mathsf}{`\t}{"1D5CD}%
323 \MathAlphabetChar{\mathsf}{`\u}{"1D5CE}%
324 \MathAlphabetChar{\mathsf}{`\v}{"1D5CF}%
325 \MathAlphabetChar{\mathsf}{`\w}{"1D5D0}%
326 \MathAlphabetChar{\mathsf}{`\x}{"1D5D1}%
327 \MathAlphabetChar{\mathsf}{`\y}{"1D5D2}%
328 \MathAlphabetChar{\mathsf}{`\z}{"1D5D3}%

```

5.3.6 Sans serif italic: `\mathsf`

<p>0123456789</p> <p><i>ABCDEFGHIJKLMNOPQRSTUVWXYZ</i></p> <p><i>abcdefghijklmnopqrstuvwxyz</i></p>	<pre> \setmathfont{Cambria Math} \$\mathsf{0123456789}\$ \ \$\mathsf{ABCDEFGHIJKLMNOPQRSTUVWXYZ}\$ \ \$\mathsf{abcdefghijklmnopqrstuvwxyz}\$ \ </pre>
---	---

Numbers (always upright):

```

329 \MathAlphabetChar{\mathsf}{`\0}{"1D7E2}%
330 \MathAlphabetChar{\mathsf}{`\1}{"1D7E3}%
331 \MathAlphabetChar{\mathsf}{`\2}{"1D7E4}%
332 \MathAlphabetChar{\mathsf}{`\3}{"1D7E5}%
333 \MathAlphabetChar{\mathsf}{`\4}{"1D7E6}%
334 \MathAlphabetChar{\mathsf}{`\5}{"1D7E7}%
335 \MathAlphabetChar{\mathsf}{`\6}{"1D7E8}%
336 \MathAlphabetChar{\mathsf}{`\7}{"1D7E9}%
337 \MathAlphabetChar{\mathsf}{`\8}{"1D7EA}%
338 \MathAlphabetChar{\mathsf}{`\9}{"1D7EB}%

```

Roman letters:

```

339 \MathAlphabetChar{\mathsf}{`\A}{"1D608}%
340 \MathAlphabetChar{\mathsf}{`\B}{"1D609}%
341 \MathAlphabetChar{\mathsf}{`\C}{"1D60A}%
342 \MathAlphabetChar{\mathsf}{`\D}{"1D60B}%
343 \MathAlphabetChar{\mathsf}{`\E}{"1D60C}%
344 \MathAlphabetChar{\mathsf}{`\F}{"1D60D}%
345 \MathAlphabetChar{\mathsf}{`\G}{"1D60E}%
346 \MathAlphabetChar{\mathsf}{`\H}{"1D60F}%
347 \MathAlphabetChar{\mathsf}{`\I}{"1D610}%
348 \MathAlphabetChar{\mathsf}{`\J}{"1D611}%
349 \MathAlphabetChar{\mathsf}{`\K}{"1D612}%
350 \MathAlphabetChar{\mathsf}{`\L}{"1D613}%
351 \MathAlphabetChar{\mathsf}{`\M}{"1D614}%
352 \MathAlphabetChar{\mathsf}{`\N}{"1D615}%
353 \MathAlphabetChar{\mathsf}{`\O}{"1D616}%
354 \MathAlphabetChar{\mathsf}{`\P}{"1D617}%

```



```

355 \MathAlphabetChar{\mathsf}{\Q}{1D618}%
356 \MathAlphabetChar{\mathsf}{\R}{1D619}%
357 \MathAlphabetChar{\mathsf}{\S}{1D61A}%
358 \MathAlphabetChar{\mathsf}{\T}{1D61B}%
359 \MathAlphabetChar{\mathsf}{\U}{1D61C}%
360 \MathAlphabetChar{\mathsf}{\V}{1D61D}%
361 \MathAlphabetChar{\mathsf}{\W}{1D61E}%
362 \MathAlphabetChar{\mathsf}{\X}{1D61F}%
363 \MathAlphabetChar{\mathsf}{\Y}{1D620}%
364 \MathAlphabetChar{\mathsf}{\Z}{1D621}%

365 \MathAlphabetChar{\mathsf}{a}{1D622}%
366 \MathAlphabetChar{\mathsf}{b}{1D623}%
367 \MathAlphabetChar{\mathsf}{c}{1D624}%
368 \MathAlphabetChar{\mathsf}{d}{1D625}%
369 \MathAlphabetChar{\mathsf}{e}{1D626}%
370 \MathAlphabetChar{\mathsf}{f}{1D627}%
371 \MathAlphabetChar{\mathsf}{g}{1D628}%
372 \MathAlphabetChar{\mathsf}{h}{1D629}%
373 \MathAlphabetChar{\mathsf}{i}{1D62A}%
374 \MathAlphabetChar{\mathsf}{j}{1D62B}%
375 \MathAlphabetChar{\mathsf}{k}{1D62C}%
376 \MathAlphabetChar{\mathsf}{l}{1D62D}%
377 \MathAlphabetChar{\mathsf}{m}{1D62E}%
378 \MathAlphabetChar{\mathsf}{n}{1D62F}%
379 \MathAlphabetChar{\mathsf}{o}{1D630}%
380 \MathAlphabetChar{\mathsf}{p}{1D631}%
381 \MathAlphabetChar{\mathsf}{q}{1D632}%
382 \MathAlphabetChar{\mathsf}{r}{1D633}%
383 \MathAlphabetChar{\mathsf}{s}{1D634}%
384 \MathAlphabetChar{\mathsf}{t}{1D635}%
385 \MathAlphabetChar{\mathsf}{u}{1D636}%
386 \MathAlphabetChar{\mathsf}{v}{1D637}%
387 \MathAlphabetChar{\mathsf}{w}{1D638}%
388 \MathAlphabetChar{\mathsf}{x}{1D639}%
389 \MathAlphabetChar{\mathsf}{y}{1D63A}%
390 \MathAlphabetChar{\mathsf}{z}{1D63B}%

```

5.3.7 Typewriter or monospaced: `\mathtt`

0123456789	<code>\setmathfont{Code2001}% ugly</code>
ABCDEFGHIJKLMN O PQRSTU VWXYZ	<code>\$\mathtt{0123456789}\$ \</code>
abcdefghijklmnopqr stuvwxyz	<code>\$\mathtt{ABCDEFGHIJKLMN O PQRSTU VWXYZ}\$ \</code>
	<code>\$\mathtt{abcdefghijklmnopqr stuvwxyz}\$ \</code>

Numbers:

```

391 \MathAlphabetChar{\mathtt}{\0}{1D7F6}%

```

392 \MathAlphabetChar{\mathhtt}{`\1}{"1D7F7}%
 393 \MathAlphabetChar{\mathhtt}{`\2}{"1D7F8}%
 394 \MathAlphabetChar{\mathhtt}{`\3}{"1D7F9}%
 395 \MathAlphabetChar{\mathhtt}{`\4}{"1D7FA}%
 396 \MathAlphabetChar{\mathhtt}{`\5}{"1D7FB}%
 397 \MathAlphabetChar{\mathhtt}{`\6}{"1D7FC}%
 398 \MathAlphabetChar{\mathhtt}{`\7}{"1D7FD}%
 399 \MathAlphabetChar{\mathhtt}{`\8}{"1D7FE}%
 400 \MathAlphabetChar{\mathhtt}{`\9}{"1D7FF}%

Letters:

401 \MathAlphabetChar{\mathhtt}{`\A}{"1D670}%
 402 \MathAlphabetChar{\mathhtt}{`\B}{"1D671}%
 403 \MathAlphabetChar{\mathhtt}{`\C}{"1D672}%
 404 \MathAlphabetChar{\mathhtt}{`\D}{"1D673}%
 405 \MathAlphabetChar{\mathhtt}{`\E}{"1D674}%
 406 \MathAlphabetChar{\mathhtt}{`\F}{"1D675}%
 407 \MathAlphabetChar{\mathhtt}{`\G}{"1D676}%
 408 \MathAlphabetChar{\mathhtt}{`\H}{"1D677}%
 409 \MathAlphabetChar{\mathhtt}{`\I}{"1D678}%
 410 \MathAlphabetChar{\mathhtt}{`\J}{"1D679}%
 411 \MathAlphabetChar{\mathhtt}{`\K}{"1D67A}%
 412 \MathAlphabetChar{\mathhtt}{`\L}{"1D67B}%
 413 \MathAlphabetChar{\mathhtt}{`\M}{"1D67C}%
 414 \MathAlphabetChar{\mathhtt}{`\N}{"1D67D}%
 415 \MathAlphabetChar{\mathhtt}{`\O}{"1D67E}%
 416 \MathAlphabetChar{\mathhtt}{`\P}{"1D67F}%
 417 \MathAlphabetChar{\mathhtt}{`\Q}{"1D680}%
 418 \MathAlphabetChar{\mathhtt}{`\R}{"1D681}%
 419 \MathAlphabetChar{\mathhtt}{`\S}{"1D682}%
 420 \MathAlphabetChar{\mathhtt}{`\T}{"1D683}%
 421 \MathAlphabetChar{\mathhtt}{`\U}{"1D684}%
 422 \MathAlphabetChar{\mathhtt}{`\V}{"1D685}%
 423 \MathAlphabetChar{\mathhtt}{`\W}{"1D686}%
 424 \MathAlphabetChar{\mathhtt}{`\X}{"1D687}%
 425 \MathAlphabetChar{\mathhtt}{`\Y}{"1D688}%
 426 \MathAlphabetChar{\mathhtt}{`\Z}{"1D689}%
 427 \MathAlphabetChar{\mathhtt}{`\a}{"1D68A}%
 428 \MathAlphabetChar{\mathhtt}{`\b}{"1D68B}%
 429 \MathAlphabetChar{\mathhtt}{`\c}{"1D68C}%
 430 \MathAlphabetChar{\mathhtt}{`\d}{"1D68D}%
 431 \MathAlphabetChar{\mathhtt}{`\e}{"1D68E}%
 432 \MathAlphabetChar{\mathhtt}{`\f}{"1D68F}%
 433 \MathAlphabetChar{\mathhtt}{`\g}{"1D690}%
 434 \MathAlphabetChar{\mathhtt}{`\h}{"1D691}%
 435 \MathAlphabetChar{\mathhtt}{`\i}{"1D692}%
 436 \MathAlphabetChar{\mathhtt}{`\j}{"1D693}%

```

437 \MathAlphabetChar{\mathhtt}{`\k}{1D694}%
438 \MathAlphabetChar{\mathhtt}{`\l}{1D695}%
439 \MathAlphabetChar{\mathhtt}{`\m}{1D696}%
440 \MathAlphabetChar{\mathhtt}{`\n}{1D697}%
441 \MathAlphabetChar{\mathhtt}{`\o}{1D698}%
442 \MathAlphabetChar{\mathhtt}{`\p}{1D699}%
443 \MathAlphabetChar{\mathhtt}{`\q}{1D69A}%
444 \MathAlphabetChar{\mathhtt}{`\r}{1D69B}%
445 \MathAlphabetChar{\mathhtt}{`\s}{1D69C}%
446 \MathAlphabetChar{\mathhtt}{`\t}{1D69D}%
447 \MathAlphabetChar{\mathhtt}{`\u}{1D69E}%
448 \MathAlphabetChar{\mathhtt}{`\v}{1D69F}%
449 \MathAlphabetChar{\mathhtt}{`\w}{1D6A0}%
450 \MathAlphabetChar{\mathhtt}{`\x}{1D6A1}%
451 \MathAlphabetChar{\mathhtt}{`\y}{1D6A2}%
452 \MathAlphabetChar{\mathhtt}{`\z}{1D6A3}%

```

5.4 Bold alphabets' character mappings

5.4.1 Bold: `\mathbf`

0123456789	<code>\setmathfont{Cambria Math}</code>
ABCDEFGHIJKLMNOPQRSTUVWXYZ	<code>\$\mathbf{0123456789}\$ \</code>
abcdefghijklmnopqrstuvwxyz	<code>\$\mathbf{ABCDEFGHIJKLMNOPQRSTUVWXYZ}\$ \</code>
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ	<code>\$\mathbf{abcdefghijklmnopqrstuvwxyz}\$ \</code>
αβγδεζηθικλμνξοπρστυφχψω	<code>\$\mathbf{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}\$ \</code>
	<code>\$\mathbf{αβγδεζηθικλμνξοπρστυφχψω}\$ \</code>

Numbers:

```

453 \MathAlphabetChar{\mathbf}{`\0}{1D7CE}%
454 \MathAlphabetChar{\mathbf}{`\1}{1D7CF}%
455 \MathAlphabetChar{\mathbf}{`\2}{1D7D0}%
456 \MathAlphabetChar{\mathbf}{`\3}{1D7D1}%
457 \MathAlphabetChar{\mathbf}{`\4}{1D7D2}%
458 \MathAlphabetChar{\mathbf}{`\5}{1D7D3}%
459 \MathAlphabetChar{\mathbf}{`\6}{1D7D4}%
460 \MathAlphabetChar{\mathbf}{`\7}{1D7D5}%
461 \MathAlphabetChar{\mathbf}{`\8}{1D7D6}%
462 \MathAlphabetChar{\mathbf}{`\9}{1D7D7}%

```

Letters:

```

463 \MathAlphabetChar{\mathbf}{`\A}{1D400}%
464 \MathAlphabetChar{\mathbf}{`\B}{1D401}%
465 \MathAlphabetChar{\mathbf}{`\C}{1D402}%
466 \MathAlphabetChar{\mathbf}{`\D}{1D403}%
467 \MathAlphabetChar{\mathbf}{`\E}{1D404}%

```

468 \MathAlphabetChar{\mathbf}{`F}{1D405}%
 469 \MathAlphabetChar{\mathbf}{`G}{1D406}%
 470 \MathAlphabetChar{\mathbf}{`H}{1D407}%
 471 \MathAlphabetChar{\mathbf}{`I}{1D408}%
 472 \MathAlphabetChar{\mathbf}{`J}{1D409}%
 473 \MathAlphabetChar{\mathbf}{`K}{1D40A}%
 474 \MathAlphabetChar{\mathbf}{`L}{1D40B}%
 475 \MathAlphabetChar{\mathbf}{`M}{1D40C}%
 476 \MathAlphabetChar{\mathbf}{`N}{1D40D}%
 477 \MathAlphabetChar{\mathbf}{`O}{1D40E}%
 478 \MathAlphabetChar{\mathbf}{`P}{1D40F}%
 479 \MathAlphabetChar{\mathbf}{`Q}{1D410}%
 480 \MathAlphabetChar{\mathbf}{`R}{1D411}%
 481 \MathAlphabetChar{\mathbf}{`S}{1D412}%
 482 \MathAlphabetChar{\mathbf}{`T}{1D413}%
 483 \MathAlphabetChar{\mathbf}{`U}{1D414}%
 484 \MathAlphabetChar{\mathbf}{`V}{1D415}%
 485 \MathAlphabetChar{\mathbf}{`W}{1D416}%
 486 \MathAlphabetChar{\mathbf}{`X}{1D417}%
 487 \MathAlphabetChar{\mathbf}{`Y}{1D418}%
 488 \MathAlphabetChar{\mathbf}{`Z}{1D419}%

 489 \MathAlphabetChar{\mathbf}{`a}{1D41A}%
 490 \MathAlphabetChar{\mathbf}{`b}{1D41B}%
 491 \MathAlphabetChar{\mathbf}{`c}{1D41C}%
 492 \MathAlphabetChar{\mathbf}{`d}{1D41D}%
 493 \MathAlphabetChar{\mathbf}{`e}{1D41E}%
 494 \MathAlphabetChar{\mathbf}{`f}{1D41F}%
 495 \MathAlphabetChar{\mathbf}{`g}{1D420}%
 496 \MathAlphabetChar{\mathbf}{`h}{1D421}%
 497 \MathAlphabetChar{\mathbf}{`i}{1D422}%
 498 \MathAlphabetChar{\mathbf}{`j}{1D423}%
 499 \MathAlphabetChar{\mathbf}{`k}{1D424}%
 500 \MathAlphabetChar{\mathbf}{`l}{1D425}%
 501 \MathAlphabetChar{\mathbf}{`m}{1D426}%
 502 \MathAlphabetChar{\mathbf}{`n}{1D427}%
 503 \MathAlphabetChar{\mathbf}{`o}{1D428}%
 504 \MathAlphabetChar{\mathbf}{`p}{1D429}%
 505 \MathAlphabetChar{\mathbf}{`q}{1D42A}%
 506 \MathAlphabetChar{\mathbf}{`r}{1D42B}%
 507 \MathAlphabetChar{\mathbf}{`s}{1D42C}%
 508 \MathAlphabetChar{\mathbf}{`t}{1D42D}%
 509 \MathAlphabetChar{\mathbf}{`u}{1D42E}%
 510 \MathAlphabetChar{\mathbf}{`v}{1D42F}%
 511 \MathAlphabetChar{\mathbf}{`w}{1D430}%
 512 \MathAlphabetChar{\mathbf}{`x}{1D431}%
 513 \MathAlphabetChar{\mathbf}{`y}{1D432}%

514 \MathAlphabetChar{\mathbf}{`z}{1D433}%

Greek letters:

515 \MathAlphabetChar{\mathbf}{913}{1D6A8}%
516 \MathAlphabetChar{\mathbf}{914}{1D6A9}%
517 \MathAlphabetChar{\mathbf}{915}{1D6AA}%
518 \MathAlphabetChar{\mathbf}{916}{1D6AB}%
519 \MathAlphabetChar{\mathbf}{917}{1D6AC}%
520 \MathAlphabetChar{\mathbf}{918}{1D6AD}%
521 \MathAlphabetChar{\mathbf}{919}{1D6AE}%
522 \MathAlphabetChar{\mathbf}{920}{1D6AF}%
523 \MathAlphabetChar{\mathbf}{921}{1D6B0}%
524 \MathAlphabetChar{\mathbf}{922}{1D6B1}%
525 \MathAlphabetChar{\mathbf}{923}{1D6B2}%
526 \MathAlphabetChar{\mathbf}{924}{1D6B3}%
527 \MathAlphabetChar{\mathbf}{925}{1D6B4}%
528 \MathAlphabetChar{\mathbf}{926}{1D6B5}%
529 \MathAlphabetChar{\mathbf}{927}{1D6B6}%
530 \MathAlphabetChar{\mathbf}{928}{1D6B7}%
531 \MathAlphabetChar{\mathbf}{929}{1D6B8}%
532 %\MathAlphabetChar{\mathbf}{??}{1D6B9}%
533 \MathAlphabetChar{\mathbf}{931}{1D6BA}%
534 \MathAlphabetChar{\mathbf}{932}{1D6BB}%
535 \MathAlphabetChar{\mathbf}{933}{1D6BC}%
536 \MathAlphabetChar{\mathbf}{934}{1D6BD}%
537 \MathAlphabetChar{\mathbf}{935}{1D6BE}%
538 \MathAlphabetChar{\mathbf}{936}{1D6BF}%
539 \MathAlphabetChar{\mathbf}{937}{1D6C0}%
540 \MathAlphabetChar{\mathbf}{2207}{1D6C1}%

Greek lowercase:

541 \MathAlphabetChar{\mathbf}{945}{1D6C2}%
542 \MathAlphabetChar{\mathbf}{946}{1D6C3}%
543 \MathAlphabetChar{\mathbf}{947}{1D6C4}%
544 \MathAlphabetChar{\mathbf}{948}{1D6C5}%
545 \MathAlphabetChar{\mathbf}{949}{1D6C6}%
546 \MathAlphabetChar{\mathbf}{950}{1D6C7}%
547 \MathAlphabetChar{\mathbf}{951}{1D6C8}%
548 \MathAlphabetChar{\mathbf}{952}{1D6C9}%
549 \MathAlphabetChar{\mathbf}{953}{1D6CA}%
550 \MathAlphabetChar{\mathbf}{954}{1D6CB}%
551 \MathAlphabetChar{\mathbf}{955}{1D6CC}%
552 \MathAlphabetChar{\mathbf}{956}{1D6CD}%
553 \MathAlphabetChar{\mathbf}{957}{1D6CE}%
554 \MathAlphabetChar{\mathbf}{958}{1D6CF}%
555 \MathAlphabetChar{\mathbf}{959}{1D6D0}%
556 \MathAlphabetChar{\mathbf}{960}{1D6D1}%

```

557 \MathAlphabetChar{\mathbf}{961}{1D6D2}%
558 \MathAlphabetChar{\mathbf}{960}{1D6D3}%
559 \MathAlphabetChar{\mathbf}{963}{1D6D4}%
560 \MathAlphabetChar{\mathbf}{964}{1D6D5}%
561 \MathAlphabetChar{\mathbf}{965}{1D6D6}%
562 \MathAlphabetChar{\mathbf}{966}{1D6D7}%
563 \MathAlphabetChar{\mathbf}{967}{1D6D8}%
564 \MathAlphabetChar{\mathbf}{968}{1D6D9}%
565 \MathAlphabetChar{\mathbf}{969}{1D6DA}%
566 \MathAlphabetChar{\mathbf}{2202}{1D6DB}%
567 %\MathAlphabetChar{\mathbf}{??}{1D6DC}% VAR EPSILON
568 %\MathAlphabetChar{\mathbf}{??}{1D6DD}% VAR THETA
569 %\MathAlphabetChar{\mathbf}{??}{1D6DE}% VAR KAPPA
570 %\MathAlphabetChar{\mathbf}{??}{1D6DF}% VAR PHI
571 %\MathAlphabetChar{\mathbf}{??}{1D6E0}% VAR RHO
572 %\MathAlphabetChar{\mathbf}{??}{1D6E1}% VAR PI

```

TODO: nabla and others

5.4.2 Bold Italic: `\mathbf{it}`

<p style="text-align: center;">0123456789</p> <p><i>ABCDEFGHIJKLMN OPQRSTUVWXYZ</i></p> <p><i>abcdefghijklmnopqrstu vwxyz</i></p> <p><i>ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ</i></p> <p><i>αβγδεζηθικλμνξορστυφχψω</i></p>	<pre> \setmathfont{Cambria Math} \$\mathbf{it}{0123456789}\$ \ \$\mathbf{it}{ABCDEFGHIJKLMN OPQRSTUVWXYZ}\$ \ \$\mathbf{it}{abcdefghijklmnopqrstu vwxyz}\$ \ \$\mathbf{it}{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}\$ \ \$\mathbf{it}{αβγδεζηθικλμνξορστυφχψω}\$ \ </pre>
--	--

Bold numbers: (always upright)

```

573 \MathAlphabetChar{\mathbf}{0}{1D7CE}%
574 \MathAlphabetChar{\mathbf}{1}{1D7CF}%
575 \MathAlphabetChar{\mathbf}{2}{1D7D0}%
576 \MathAlphabetChar{\mathbf}{3}{1D7D1}%
577 \MathAlphabetChar{\mathbf}{4}{1D7D2}%
578 \MathAlphabetChar{\mathbf}{5}{1D7D3}%
579 \MathAlphabetChar{\mathbf}{6}{1D7D4}%
580 \MathAlphabetChar{\mathbf}{7}{1D7D5}%
581 \MathAlphabetChar{\mathbf}{8}{1D7D6}%
582 \MathAlphabetChar{\mathbf}{9}{1D7D7}%

```

Letters:

```

583 \MathAlphabetChar{\mathbf}{A}{1D468}%
584 \MathAlphabetChar{\mathbf}{B}{1D469}%
585 \MathAlphabetChar{\mathbf}{C}{1D46A}%
586 \MathAlphabetChar{\mathbf}{D}{1D46B}%
587 \MathAlphabetChar{\mathbf}{E}{1D46C}%

```

588 \MathAlphabetChar{\mathbf}{F}{1D46D}%
589 \MathAlphabetChar{\mathbf}{G}{1D46E}%
590 \MathAlphabetChar{\mathbf}{H}{1D46F}%
591 \MathAlphabetChar{\mathbf}{I}{1D470}%
592 \MathAlphabetChar{\mathbf}{J}{1D471}%
593 \MathAlphabetChar{\mathbf}{K}{1D472}%
594 \MathAlphabetChar{\mathbf}{L}{1D473}%
595 \MathAlphabetChar{\mathbf}{M}{1D474}%
596 \MathAlphabetChar{\mathbf}{N}{1D475}%
597 \MathAlphabetChar{\mathbf}{O}{1D476}%
598 \MathAlphabetChar{\mathbf}{P}{1D477}%
599 \MathAlphabetChar{\mathbf}{Q}{1D478}%
600 \MathAlphabetChar{\mathbf}{R}{1D479}%
601 \MathAlphabetChar{\mathbf}{S}{1D47A}%
602 \MathAlphabetChar{\mathbf}{T}{1D47B}%
603 \MathAlphabetChar{\mathbf}{U}{1D47C}%
604 \MathAlphabetChar{\mathbf}{V}{1D47D}%
605 \MathAlphabetChar{\mathbf}{W}{1D47E}%
606 \MathAlphabetChar{\mathbf}{X}{1D47F}%
607 \MathAlphabetChar{\mathbf}{Y}{1D480}%
608 \MathAlphabetChar{\mathbf}{Z}{1D481}%

609 \MathAlphabetChar{\mathbf}{a}{1D482}%
610 \MathAlphabetChar{\mathbf}{b}{1D483}%
611 \MathAlphabetChar{\mathbf}{c}{1D484}%
612 \MathAlphabetChar{\mathbf}{d}{1D485}%
613 \MathAlphabetChar{\mathbf}{e}{1D486}%
614 \MathAlphabetChar{\mathbf}{f}{1D487}%
615 \MathAlphabetChar{\mathbf}{g}{1D488}%
616 \MathAlphabetChar{\mathbf}{h}{1D489}%
617 \MathAlphabetChar{\mathbf}{i}{1D48A}%
618 \MathAlphabetChar{\mathbf}{j}{1D48B}%
619 \MathAlphabetChar{\mathbf}{k}{1D48C}%
620 \MathAlphabetChar{\mathbf}{l}{1D48D}%
621 \MathAlphabetChar{\mathbf}{m}{1D48E}%
622 \MathAlphabetChar{\mathbf}{n}{1D48F}%
623 \MathAlphabetChar{\mathbf}{o}{1D490}%
624 \MathAlphabetChar{\mathbf}{p}{1D491}%
625 \MathAlphabetChar{\mathbf}{q}{1D492}%
626 \MathAlphabetChar{\mathbf}{r}{1D493}%
627 \MathAlphabetChar{\mathbf}{s}{1D494}%
628 \MathAlphabetChar{\mathbf}{t}{1D495}%
629 \MathAlphabetChar{\mathbf}{u}{1D496}%
630 \MathAlphabetChar{\mathbf}{v}{1D497}%
631 \MathAlphabetChar{\mathbf}{w}{1D498}%
632 \MathAlphabetChar{\mathbf}{x}{1D499}%
633 \MathAlphabetChar{\mathbf}{y}{1D49A}%

634 \MathAlphabetChar{\mathbf it}{`z}{1D49B}%

Greek letters:

635 \MathAlphabetChar{\mathbf it}{913}{1D71C}%
636 \MathAlphabetChar{\mathbf it}{914}{1D71D}%
637 \MathAlphabetChar{\mathbf it}{915}{1D71E}%
638 \MathAlphabetChar{\mathbf it}{916}{1D71F}%
639 \MathAlphabetChar{\mathbf it}{917}{1D720}%
640 \MathAlphabetChar{\mathbf it}{918}{1D721}%
641 \MathAlphabetChar{\mathbf it}{919}{1D722}%
642 \MathAlphabetChar{\mathbf it}{920}{1D723}%
643 \MathAlphabetChar{\mathbf it}{921}{1D724}%
644 \MathAlphabetChar{\mathbf it}{922}{1D725}%
645 \MathAlphabetChar{\mathbf it}{923}{1D726}%
646 \MathAlphabetChar{\mathbf it}{924}{1D727}%
647 \MathAlphabetChar{\mathbf it}{925}{1D728}%
648 \MathAlphabetChar{\mathbf it}{926}{1D729}%
649 \MathAlphabetChar{\mathbf it}{927}{1D72A}%
650 \MathAlphabetChar{\mathbf it}{928}{1D72B}%
651 \MathAlphabetChar{\mathbf it}{929}{1D72C}%
652 %\MathAlphabetChar{\mathbf it}{??}{1D72D}%
653 \MathAlphabetChar{\mathbf it}{931}{1D72E}%
654 \MathAlphabetChar{\mathbf it}{932}{1D72F}%
655 \MathAlphabetChar{\mathbf it}{933}{1D730}%
656 \MathAlphabetChar{\mathbf it}{934}{1D731}%
657 \MathAlphabetChar{\mathbf it}{935}{1D732}%
658 \MathAlphabetChar{\mathbf it}{936}{1D733}%
659 \MathAlphabetChar{\mathbf it}{937}{1D734}%
660 \MathAlphabetChar{\mathbf it}{2207}{1D735}%

Greek lowercase:

661 \MathAlphabetChar{\mathbf it}{945}{1D736}%
662 \MathAlphabetChar{\mathbf it}{946}{1D737}%
663 \MathAlphabetChar{\mathbf it}{947}{1D738}%
664 \MathAlphabetChar{\mathbf it}{948}{1D739}%
665 \MathAlphabetChar{\mathbf it}{949}{1D73A}%
666 \MathAlphabetChar{\mathbf it}{950}{1D73B}%
667 \MathAlphabetChar{\mathbf it}{951}{1D73C}%
668 \MathAlphabetChar{\mathbf it}{952}{1D73D}%
669 \MathAlphabetChar{\mathbf it}{953}{1D73E}%
670 \MathAlphabetChar{\mathbf it}{954}{1D73F}%
671 \MathAlphabetChar{\mathbf it}{955}{1D740}%
672 \MathAlphabetChar{\mathbf it}{956}{1D741}%
673 \MathAlphabetChar{\mathbf it}{957}{1D742}%
674 \MathAlphabetChar{\mathbf it}{958}{1D743}%
675 \MathAlphabetChar{\mathbf it}{959}{1D744}%
676 \MathAlphabetChar{\mathbf it}{960}{1D745}%


```

677 \MathAlphabetChar{\mathbf{it}}{961}{1D746}%
678 \MathAlphabetChar{\mathbf{it}}{960}{1D747}%
679 \MathAlphabetChar{\mathbf{it}}{963}{1D748}%
680 \MathAlphabetChar{\mathbf{it}}{964}{1D749}%
681 \MathAlphabetChar{\mathbf{it}}{965}{1D74A}%
682 \MathAlphabetChar{\mathbf{it}}{966}{1D74B}%
683 \MathAlphabetChar{\mathbf{it}}{967}{1D74C}%
684 \MathAlphabetChar{\mathbf{it}}{968}{1D74D}%
685 \MathAlphabetChar{\mathbf{it}}{969}{1D74E}%
686 \MathAlphabetChar{\mathbf{it}}{2202}{1D74F}%
687 %\MathAlphabetChar{\mathbf{it}}{??}{1D750}% VAR EPSILON
688 %\MathAlphabetChar{\mathbf{it}}{??}{1D751}% VAR THETA
689 %\MathAlphabetChar{\mathbf{it}}{??}{1D752}% VAR KAPPA
690 %\MathAlphabetChar{\mathbf{it}}{??}{1D753}% VAR PHI
691 %\MathAlphabetChar{\mathbf{it}}{??}{1D754}% VAR RHO
692 %\MathAlphabetChar{\mathbf{it}}{??}{1D755}% VAR PI

```

5.4.3 Bold fractur or fraktur or blackletter: `\mathbffrak`

ABCDEFGHIJKLMNOPQRSTUVWXYZ	<code>\setmathfont{Cambria Math}</code>
abcdefghijklmnopqrstuvwxyz	<code>\$\mathbffrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}\$ \\</code> <code>\$\mathbffrak{abcdefghijklmnopqrstuvwxyz}\$ \\</code>

Bold numbers: (always upright)

```

693 \MathAlphabetChar{\mathbffrak}{0}{1D7CE}%
694 \MathAlphabetChar{\mathbffrak}{1}{1D7CF}%
695 \MathAlphabetChar{\mathbffrak}{2}{1D7D0}%
696 \MathAlphabetChar{\mathbffrak}{3}{1D7D1}%
697 \MathAlphabetChar{\mathbffrak}{4}{1D7D2}%
698 \MathAlphabetChar{\mathbffrak}{5}{1D7D3}%
699 \MathAlphabetChar{\mathbffrak}{6}{1D7D4}%
700 \MathAlphabetChar{\mathbffrak}{7}{1D7D5}%
701 \MathAlphabetChar{\mathbffrak}{8}{1D7D6}%
702 \MathAlphabetChar{\mathbffrak}{9}{1D7D7}%

```

Letters:

```

703 \MathAlphabetChar{\mathbffrak}{A}{1D56C}%
704 \MathAlphabetChar{\mathbffrak}{B}{1D56D}%
705 \MathAlphabetChar{\mathbffrak}{C}{1D56E}%
706 \MathAlphabetChar{\mathbffrak}{D}{1D56F}%
707 \MathAlphabetChar{\mathbffrak}{E}{1D570}%
708 \MathAlphabetChar{\mathbffrak}{F}{1D571}%
709 \MathAlphabetChar{\mathbffrak}{G}{1D572}%
710 \MathAlphabetChar{\mathbffrak}{H}{1D573}%
711 \MathAlphabetChar{\mathbffrak}{I}{1D574}%
712 \MathAlphabetChar{\mathbffrak}{J}{1D575}%

```

713 \MathAlphabetChar{\mathbffrak}{`\K}{1D576}%
714 \MathAlphabetChar{\mathbffrak}{`\L}{1D577}%
715 \MathAlphabetChar{\mathbffrak}{`\M}{1D578}%
716 \MathAlphabetChar{\mathbffrak}{`\N}{1D579}%
717 \MathAlphabetChar{\mathbffrak}{`\O}{1D57A}%
718 \MathAlphabetChar{\mathbffrak}{`\P}{1D57B}%
719 \MathAlphabetChar{\mathbffrak}{`\Q}{1D57C}%
720 \MathAlphabetChar{\mathbffrak}{`\R}{1D57D}%
721 \MathAlphabetChar{\mathbffrak}{`\S}{1D57E}%
722 \MathAlphabetChar{\mathbffrak}{`\T}{1D57F}%
723 \MathAlphabetChar{\mathbffrak}{`\U}{1D580}%
724 \MathAlphabetChar{\mathbffrak}{`\V}{1D581}%
725 \MathAlphabetChar{\mathbffrak}{`\W}{1D582}%
726 \MathAlphabetChar{\mathbffrak}{`\X}{1D583}%
727 \MathAlphabetChar{\mathbffrak}{`\Y}{1D584}%
728 \MathAlphabetChar{\mathbffrak}{`\Z}{1D585}%

729 \MathAlphabetChar{\mathbffrak}{`\a}{1D586}%
730 \MathAlphabetChar{\mathbffrak}{`\b}{1D587}%
731 \MathAlphabetChar{\mathbffrak}{`\c}{1D588}%
732 \MathAlphabetChar{\mathbffrak}{`\d}{1D589}%
733 \MathAlphabetChar{\mathbffrak}{`\e}{1D58A}%
734 \MathAlphabetChar{\mathbffrak}{`\f}{1D58B}%
735 \MathAlphabetChar{\mathbffrak}{`\g}{1D58C}%
736 \MathAlphabetChar{\mathbffrak}{`\h}{1D58D}%
737 \MathAlphabetChar{\mathbffrak}{`\i}{1D58E}%
738 \MathAlphabetChar{\mathbffrak}{`\j}{1D58F}%
739 \MathAlphabetChar{\mathbffrak}{`\k}{1D590}%
740 \MathAlphabetChar{\mathbffrak}{`\l}{1D591}%
741 \MathAlphabetChar{\mathbffrak}{`\m}{1D592}%
742 \MathAlphabetChar{\mathbffrak}{`\n}{1D593}%
743 \MathAlphabetChar{\mathbffrak}{`\o}{1D594}%
744 \MathAlphabetChar{\mathbffrak}{`\p}{1D595}%
745 \MathAlphabetChar{\mathbffrak}{`\q}{1D596}%
746 \MathAlphabetChar{\mathbffrak}{`\r}{1D597}%
747 \MathAlphabetChar{\mathbffrak}{`\s}{1D598}%
748 \MathAlphabetChar{\mathbffrak}{`\t}{1D599}%
749 \MathAlphabetChar{\mathbffrak}{`\u}{1D59A}%
750 \MathAlphabetChar{\mathbffrak}{`\v}{1D59B}%
751 \MathAlphabetChar{\mathbffrak}{`\w}{1D59C}%
752 \MathAlphabetChar{\mathbffrak}{`\x}{1D59D}%
753 \MathAlphabetChar{\mathbffrak}{`\y}{1D59E}%
754 \MathAlphabetChar{\mathbffrak}{`\z}{1D59F}%

5.4.4 Bold script or calligraphic: `\mathbfscr`

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

```
\setmathfont{Cambria Math}
$\mathbfscr{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbfscr{abcdefghijklmnopqrstuvwxyz}$ \\
```

Bold numbers: (always upright)

```
755 \MathAlphabetChar{\mathbfscr}{`0}{1D7CE}%
756 \MathAlphabetChar{\mathbfscr}{`1}{1D7CF}%
757 \MathAlphabetChar{\mathbfscr}{`2}{1D7D0}%
758 \MathAlphabetChar{\mathbfscr}{`3}{1D7D1}%
759 \MathAlphabetChar{\mathbfscr}{`4}{1D7D2}%
760 \MathAlphabetChar{\mathbfscr}{`5}{1D7D3}%
761 \MathAlphabetChar{\mathbfscr}{`6}{1D7D4}%
762 \MathAlphabetChar{\mathbfscr}{`7}{1D7D5}%
763 \MathAlphabetChar{\mathbfscr}{`8}{1D7D6}%
764 \MathAlphabetChar{\mathbfscr}{`9}{1D7D7}%
```

Letters:

```
765 \MathAlphabetChar{\mathbfscr}{`A}{1D4D0}%
766 \MathAlphabetChar{\mathbfscr}{`B}{1D4D1}%
767 \MathAlphabetChar{\mathbfscr}{`C}{1D4D2}%
768 \MathAlphabetChar{\mathbfscr}{`D}{1D4D3}%
769 \MathAlphabetChar{\mathbfscr}{`E}{1D4D4}%
770 \MathAlphabetChar{\mathbfscr}{`F}{1D4D5}%
771 \MathAlphabetChar{\mathbfscr}{`G}{1D4D6}%
772 \MathAlphabetChar{\mathbfscr}{`H}{1D4D7}%
773 \MathAlphabetChar{\mathbfscr}{`I}{1D4D8}%
774 \MathAlphabetChar{\mathbfscr}{`J}{1D4D9}%
775 \MathAlphabetChar{\mathbfscr}{`K}{1D4DA}%
776 \MathAlphabetChar{\mathbfscr}{`L}{1D4DB}%
777 \MathAlphabetChar{\mathbfscr}{`M}{1D4DC}%
778 \MathAlphabetChar{\mathbfscr}{`N}{1D4DD}%
779 \MathAlphabetChar{\mathbfscr}{`O}{1D4DE}%
780 \MathAlphabetChar{\mathbfscr}{`P}{1D4DF}%
781 \MathAlphabetChar{\mathbfscr}{`Q}{1D4E0}%
782 \MathAlphabetChar{\mathbfscr}{`R}{1D4E1}%
783 \MathAlphabetChar{\mathbfscr}{`S}{1D4E2}%
784 \MathAlphabetChar{\mathbfscr}{`T}{1D4E3}%
785 \MathAlphabetChar{\mathbfscr}{`U}{1D4E4}%
786 \MathAlphabetChar{\mathbfscr}{`V}{1D4E5}%
787 \MathAlphabetChar{\mathbfscr}{`W}{1D4E6}%
788 \MathAlphabetChar{\mathbfscr}{`X}{1D4E7}%
789 \MathAlphabetChar{\mathbfscr}{`Y}{1D4E8}%
790 \MathAlphabetChar{\mathbfscr}{`Z}{1D4E9}%
791 \MathAlphabetChar{\mathbfscr}{`a}{1D4EA}%
```

```

792 \MathAlphabetChar{\mathbfscr}{`b}{1D4EB}%
793 \MathAlphabetChar{\mathbfscr}{`c}{1D4EC}%
794 \MathAlphabetChar{\mathbfscr}{`d}{1D4ED}%
795 \MathAlphabetChar{\mathbfscr}{`e}{1D4EE}%
796 \MathAlphabetChar{\mathbfscr}{`f}{1D4EF}%
797 \MathAlphabetChar{\mathbfscr}{`g}{1D4F0}%
798 \MathAlphabetChar{\mathbfscr}{`h}{1D4F1}%
799 \MathAlphabetChar{\mathbfscr}{`i}{1D4F2}%
800 \MathAlphabetChar{\mathbfscr}{`j}{1D4F3}%
801 \MathAlphabetChar{\mathbfscr}{`k}{1D4F4}%
802 \MathAlphabetChar{\mathbfscr}{`l}{1D4F5}%
803 \MathAlphabetChar{\mathbfscr}{`m}{1D4F6}%
804 \MathAlphabetChar{\mathbfscr}{`n}{1D4F7}%
805 \MathAlphabetChar{\mathbfscr}{`o}{1D4F8}%
806 \MathAlphabetChar{\mathbfscr}{`p}{1D4F9}%
807 \MathAlphabetChar{\mathbfscr}{`q}{1D4FA}%
808 \MathAlphabetChar{\mathbfscr}{`r}{1D4FB}%
809 \MathAlphabetChar{\mathbfscr}{`s}{1D4FC}%
810 \MathAlphabetChar{\mathbfscr}{`t}{1D4FD}%
811 \MathAlphabetChar{\mathbfscr}{`u}{1D4FE}%
812 \MathAlphabetChar{\mathbfscr}{`v}{1D4FF}%
813 \MathAlphabetChar{\mathbfscr}{`w}{1D500}%
814 \MathAlphabetChar{\mathbfscr}{`x}{1D501}%
815 \MathAlphabetChar{\mathbfscr}{`y}{1D502}%
816 \MathAlphabetChar{\mathbfscr}{`z}{1D503}%

```

5.4.5 Bold sans serif: `\mathbfsf`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz



```

\setmathfont{Cambria Math}
$\mathbfsf{0123456789}$ \
$\mathbfsf{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \
$\mathbfsf{abcdefghijklmnopqrstuvwxyz}$ \
$\mathbfsf{ABΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \
$\mathbfsf{αβγδεζηθικλμνξοπρστυφψω}$ \

```

Numbers: (always upright)

```

817 \MathAlphabetChar{\mathbfsf}{`0}{1D7EC}%
818 \MathAlphabetChar{\mathbfsf}{`1}{1D7ED}%
819 \MathAlphabetChar{\mathbfsf}{`2}{1D7EE}%
820 \MathAlphabetChar{\mathbfsf}{`3}{1D7EF}%
821 \MathAlphabetChar{\mathbfsf}{`4}{1D7F0}%
822 \MathAlphabetChar{\mathbfsf}{`5}{1D7F1}%
823 \MathAlphabetChar{\mathbfsf}{`6}{1D7F2}%
824 \MathAlphabetChar{\mathbfsf}{`7}{1D7F3}%
825 \MathAlphabetChar{\mathbfsf}{`8}{1D7F4}%
826 \MathAlphabetChar{\mathbfsf}{`9}{1D7F5}%

```

Letters:

```

827 \MathAlphabetChar{\mathbfsf}{`A}{"1D5D4}%
828 \MathAlphabetChar{\mathbfsf}{`B}{"1D5D5}%
829 \MathAlphabetChar{\mathbfsf}{`C}{"1D5D6}%
830 \MathAlphabetChar{\mathbfsf}{`D}{"1D5D7}%
831 \MathAlphabetChar{\mathbfsf}{`E}{"1D5D8}%
832 \MathAlphabetChar{\mathbfsf}{`F}{"1D5D9}%
833 \MathAlphabetChar{\mathbfsf}{`G}{"1D5DA}%
834 \MathAlphabetChar{\mathbfsf}{`H}{"1D5DB}%
835 \MathAlphabetChar{\mathbfsf}{`I}{"1D5DC}%
836 \MathAlphabetChar{\mathbfsf}{`J}{"1D5DD}%
837 \MathAlphabetChar{\mathbfsf}{`K}{"1D5DE}%
838 \MathAlphabetChar{\mathbfsf}{`L}{"1D5DF}%
839 \MathAlphabetChar{\mathbfsf}{`M}{"1D5E0}%
840 \MathAlphabetChar{\mathbfsf}{`N}{"1D5E1}%
841 \MathAlphabetChar{\mathbfsf}{`O}{"1D5E2}%
842 \MathAlphabetChar{\mathbfsf}{`P}{"1D5E3}%
843 \MathAlphabetChar{\mathbfsf}{`Q}{"1D5E4}%
844 \MathAlphabetChar{\mathbfsf}{`R}{"1D5E5}%
845 \MathAlphabetChar{\mathbfsf}{`S}{"1D5E6}%
846 \MathAlphabetChar{\mathbfsf}{`T}{"1D5E7}%
847 \MathAlphabetChar{\mathbfsf}{`U}{"1D5E8}%
848 \MathAlphabetChar{\mathbfsf}{`V}{"1D5E9}%
849 \MathAlphabetChar{\mathbfsf}{`W}{"1D5EA}%
850 \MathAlphabetChar{\mathbfsf}{`X}{"1D5EB}%
851 \MathAlphabetChar{\mathbfsf}{`Y}{"1D5EC}%
852 \MathAlphabetChar{\mathbfsf}{`Z}{"1D5ED}%

853 \MathAlphabetChar{\mathbfsf}{`a}{"1D5EE}%
854 \MathAlphabetChar{\mathbfsf}{`b}{"1D5EF}%
855 \MathAlphabetChar{\mathbfsf}{`c}{"1D5F0}%
856 \MathAlphabetChar{\mathbfsf}{`d}{"1D5F1}%
857 \MathAlphabetChar{\mathbfsf}{`e}{"1D5F2}%
858 \MathAlphabetChar{\mathbfsf}{`f}{"1D5F3}%
859 \MathAlphabetChar{\mathbfsf}{`g}{"1D5F4}%
860 \MathAlphabetChar{\mathbfsf}{`h}{"1D5F5}%
861 \MathAlphabetChar{\mathbfsf}{`i}{"1D5F6}%
862 \MathAlphabetChar{\mathbfsf}{`j}{"1D5F7}%
863 \MathAlphabetChar{\mathbfsf}{`k}{"1D5F8}%
864 \MathAlphabetChar{\mathbfsf}{`l}{"1D5F9}%
865 \MathAlphabetChar{\mathbfsf}{`m}{"1D5FA}%
866 \MathAlphabetChar{\mathbfsf}{`n}{"1D5FB}%
867 \MathAlphabetChar{\mathbfsf}{`o}{"1D5FC}%
868 \MathAlphabetChar{\mathbfsf}{`p}{"1D5FD}%
869 \MathAlphabetChar{\mathbfsf}{`q}{"1D5FE}%
870 \MathAlphabetChar{\mathbfsf}{`r}{"1D5FF}%
871 \MathAlphabetChar{\mathbfsf}{`s}{"1D600}%

```

\backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ t $\}$ {1D601}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ u $\}$ {1D602}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ v $\}$ {1D603}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ w $\}$ {1D604}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ x $\}$ {1D605}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ y $\}$ {1D606}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{\backslash$ z $\}$ {1D607}%

Greek letters:

\backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{913\}$ {1D756}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{914\}$ {1D757}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{915\}$ {1D758}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{916\}$ {1D759}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{917\}$ {1D75A}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{918\}$ {1D75B}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{919\}$ {1D75C}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{920\}$ {1D75D}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{921\}$ {1D75E}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{922\}$ {1D75F}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{923\}$ {1D760}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{924\}$ {1D761}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{925\}$ {1D762}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{926\}$ {1D763}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{927\}$ {1D764}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{928\}$ {1D765}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{929\}$ {1D766}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{??\}$ {1D767}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{931\}$ {1D768}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{932\}$ {1D769}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{933\}$ {1D76A}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{934\}$ {1D76B}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{935\}$ {1D76C}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{936\}$ {1D76D}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{937\}$ {1D76E}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{2207\}$ {1D76F}%

Greek lowercase:

\backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{945\}$ {1D770}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{946\}$ {1D771}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{947\}$ {1D772}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{948\}$ {1D773}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{949\}$ {1D774}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{950\}$ {1D775}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{951\}$ {1D776}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{952\}$ {1D777}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{953\}$ {1D778}%
 \backslash MathAlphabetChar $\{\backslash$ mathbfsf $\}\{954\}$ {1D779}%

948 \MathAlphabetChar{\mathbfsfit}{\B}{1D63D}%
 949 \MathAlphabetChar{\mathbfsfit}{\C}{1D63E}%
 950 \MathAlphabetChar{\mathbfsfit}{\D}{1D63F}%
 951 \MathAlphabetChar{\mathbfsfit}{\E}{1D640}%
 952 \MathAlphabetChar{\mathbfsfit}{\F}{1D641}%
 953 \MathAlphabetChar{\mathbfsfit}{\G}{1D642}%
 954 \MathAlphabetChar{\mathbfsfit}{\H}{1D643}%
 955 \MathAlphabetChar{\mathbfsfit}{\I}{1D644}%
 956 \MathAlphabetChar{\mathbfsfit}{\J}{1D645}%
 957 \MathAlphabetChar{\mathbfsfit}{\K}{1D646}%
 958 \MathAlphabetChar{\mathbfsfit}{\L}{1D647}%
 959 \MathAlphabetChar{\mathbfsfit}{\M}{1D648}%
 960 \MathAlphabetChar{\mathbfsfit}{\N}{1D649}%
 961 \MathAlphabetChar{\mathbfsfit}{\O}{1D64A}%
 962 \MathAlphabetChar{\mathbfsfit}{\P}{1D64B}%
 963 \MathAlphabetChar{\mathbfsfit}{\Q}{1D64C}%
 964 \MathAlphabetChar{\mathbfsfit}{\R}{1D64D}%
 965 \MathAlphabetChar{\mathbfsfit}{\S}{1D64E}%
 966 \MathAlphabetChar{\mathbfsfit}{\T}{1D64F}%
 967 \MathAlphabetChar{\mathbfsfit}{\U}{1D650}%
 968 \MathAlphabetChar{\mathbfsfit}{\V}{1D651}%
 969 \MathAlphabetChar{\mathbfsfit}{\W}{1D652}%
 970 \MathAlphabetChar{\mathbfsfit}{\X}{1D653}%
 971 \MathAlphabetChar{\mathbfsfit}{\Y}{1D654}%
 972 \MathAlphabetChar{\mathbfsfit}{\Z}{1D655}%

 973 \MathAlphabetChar{\mathbfsfit}{\a}{1D656}%
 974 \MathAlphabetChar{\mathbfsfit}{\b}{1D657}%
 975 \MathAlphabetChar{\mathbfsfit}{\c}{1D658}%
 976 \MathAlphabetChar{\mathbfsfit}{\d}{1D659}%
 977 \MathAlphabetChar{\mathbfsfit}{\e}{1D65A}%
 978 \MathAlphabetChar{\mathbfsfit}{\f}{1D65B}%
 979 \MathAlphabetChar{\mathbfsfit}{\g}{1D65C}%
 980 \MathAlphabetChar{\mathbfsfit}{\h}{1D65D}%
 981 \MathAlphabetChar{\mathbfsfit}{\i}{1D65E}%
 982 \MathAlphabetChar{\mathbfsfit}{\j}{1D65F}%
 983 \MathAlphabetChar{\mathbfsfit}{\k}{1D660}%
 984 \MathAlphabetChar{\mathbfsfit}{\l}{1D661}%
 985 \MathAlphabetChar{\mathbfsfit}{\m}{1D662}%
 986 \MathAlphabetChar{\mathbfsfit}{\n}{1D663}%
 987 \MathAlphabetChar{\mathbfsfit}{\o}{1D664}%
 988 \MathAlphabetChar{\mathbfsfit}{\p}{1D665}%
 989 \MathAlphabetChar{\mathbfsfit}{\q}{1D666}%
 990 \MathAlphabetChar{\mathbfsfit}{\r}{1D667}%
 991 \MathAlphabetChar{\mathbfsfit}{\s}{1D668}%
 992 \MathAlphabetChar{\mathbfsfit}{\t}{1D669}%
 993 \MathAlphabetChar{\mathbfsfit}{\u}{1D66A}%

994 \MathAlphabetChar{\mathbfsfit}{\v}{1D66B}%
 995 \MathAlphabetChar{\mathbfsfit}{\w}{1D66C}%
 996 \MathAlphabetChar{\mathbfsfit}{\x}{1D66D}%
 997 \MathAlphabetChar{\mathbfsfit}{\y}{1D66E}%
 998 \MathAlphabetChar{\mathbfsfit}{\z}{1D66F}%

Greek letters:

999 \MathAlphabetChar{\mathbfsfit}{913}{1D790}%
 1000 \MathAlphabetChar{\mathbfsfit}{914}{1D791}%
 1001 \MathAlphabetChar{\mathbfsfit}{915}{1D792}%
 1002 \MathAlphabetChar{\mathbfsfit}{916}{1D793}%
 1003 \MathAlphabetChar{\mathbfsfit}{917}{1D794}%
 1004 \MathAlphabetChar{\mathbfsfit}{918}{1D795}%
 1005 \MathAlphabetChar{\mathbfsfit}{919}{1D796}%
 1006 \MathAlphabetChar{\mathbfsfit}{920}{1D797}%
 1007 \MathAlphabetChar{\mathbfsfit}{921}{1D798}%
 1008 \MathAlphabetChar{\mathbfsfit}{922}{1D799}%
 1009 \MathAlphabetChar{\mathbfsfit}{923}{1D79A}%
 1010 \MathAlphabetChar{\mathbfsfit}{924}{1D79B}%
 1011 \MathAlphabetChar{\mathbfsfit}{925}{1D79C}%
 1012 \MathAlphabetChar{\mathbfsfit}{926}{1D79D}%
 1013 \MathAlphabetChar{\mathbfsfit}{927}{1D79E}%
 1014 \MathAlphabetChar{\mathbfsfit}{928}{1D79F}%
 1015 \MathAlphabetChar{\mathbfsfit}{929}{1D7A0}%
 1016 %\MathAlphabetChar{\mathbfsfit}{??}{1D7A1}%
 1017 \MathAlphabetChar{\mathbfsfit}{931}{1D7A2}%
 1018 \MathAlphabetChar{\mathbfsfit}{932}{1D7A3}%
 1019 \MathAlphabetChar{\mathbfsfit}{933}{1D7A4}%
 1020 \MathAlphabetChar{\mathbfsfit}{934}{1D7A5}%
 1021 \MathAlphabetChar{\mathbfsfit}{935}{1D7A6}%
 1022 \MathAlphabetChar{\mathbfsfit}{936}{1D7A7}%
 1023 \MathAlphabetChar{\mathbfsfit}{937}{1D7A8}%
 1024 \MathAlphabetChar{\mathbfsfit}{2207}{1D7A9}%

Greek lowercase:

1025 \MathAlphabetChar{\mathbfsfit}{945}{1D7AA}%
 1026 \MathAlphabetChar{\mathbfsfit}{946}{1D7AB}%
 1027 \MathAlphabetChar{\mathbfsfit}{947}{1D7AC}%
 1028 \MathAlphabetChar{\mathbfsfit}{948}{1D7AD}%
 1029 \MathAlphabetChar{\mathbfsfit}{949}{1D7AE}%
 1030 \MathAlphabetChar{\mathbfsfit}{950}{1D7AF}%
 1031 \MathAlphabetChar{\mathbfsfit}{951}{1D7B0}%
 1032 \MathAlphabetChar{\mathbfsfit}{952}{1D7B1}%
 1033 \MathAlphabetChar{\mathbfsfit}{953}{1D7B2}%
 1034 \MathAlphabetChar{\mathbfsfit}{954}{1D7B3}%
 1035 \MathAlphabetChar{\mathbfsfit}{955}{1D7B4}%
 1036 \MathAlphabetChar{\mathbfsfit}{956}{1D7B5}%

```

1037 \MathAlphabetChar{\mathbfsfit}{957}{1D7B6}%
1038 \MathAlphabetChar{\mathbfsfit}{958}{1D7B7}%
1039 \MathAlphabetChar{\mathbfsfit}{959}{1D7B8}%
1040 \MathAlphabetChar{\mathbfsfit}{960}{1D7B9}%
1041 \MathAlphabetChar{\mathbfsfit}{961}{1D7BA}%
1042 \MathAlphabetChar{\mathbfsfit}{960}{1D7BB}%
1043 \MathAlphabetChar{\mathbfsfit}{963}{1D7BC}%
1044 \MathAlphabetChar{\mathbfsfit}{964}{1D7BD}%
1045 \MathAlphabetChar{\mathbfsfit}{965}{1D7BE}%
1046 \MathAlphabetChar{\mathbfsfit}{966}{1D7BF}%
1047 \MathAlphabetChar{\mathbfsfit}{967}{1D7C0}%
1048 \MathAlphabetChar{\mathbfsfit}{968}{1D7C1}%
1049 \MathAlphabetChar{\mathbfsfit}{969}{1D7C2}%
1050 \MathAlphabetChar{\mathbfsfit}{2202}{1D7C3}%
1051 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C4}% VAR EPSILON
1052 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C5}% VAR THETA
1053 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C6}% VAR KAPPA
1054 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C7}% VAR PHI
1055 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C8}% VAR RHO
1056 %\MathAlphabetChar{\mathbfsfit}{???}{1D7C9}% VAR PI

```

File III

stix table data extraction

The source for the \TeX names for the very large number of mathematical glyphs are provided via Barbara Beeton's table file for the `stix` project ([ams.org/STIX](http://www.ams.org/STIX)). A version is located at <http://www.ams.org/STIX/bnb/stix-tbl.asc> but check <http://www.ams.org/STIX/> for more up-to-date info.

A single file is produced containing all (more than 3298) symbols. Future optimisations might include generating various (possibly overlapping) subsets so not all definitions must be read just to redefine a small range of symbols. Performance for now seems to be acceptable without such measures.

```

1 #!/bin/sh
2
3 cat stix-tbl.asc |
4 awk '

```

If the USV isn't repeated (TODO: check this is valid!) and the entry isn't one of the weird ones in the big block at the end of the `stix` table (TODO: check that out!)

```

5 {if (usv != substr($0,2,5) && substr($0,2,1) != " ")
6     {usv = substr($0,2,5);
7     texname = substr($0,84,25);
8     class = substr($0,57,1);

```

If the USV has a macro name, and a class, and it isn't reserved (*i.e.*, doubled up with a previously assigned glyph)...

Print the actual entry corresponding to the unicode character:

Now replace the STIX class abbreviations with their T_EX macro names.

A ‘fence’ defined by the STIX table is something like `\vert`; in \XeTeX this is just a `\mathord` that will grow with the magic of `\XeTeXmathchardef`.

A Documenting maths support in the NFSS

In the following, $\langle NFSS\ decl. \rangle$ stands for something like $\{T1\}\{l_{mr}\}\{m\}\{n\}$.

$$\backslash\mathrm{DeclareSymbolFont}\{\langle name\rangle\}\langle NFSS\ decl.\rangle$$

Maths alphabet fonts Fonts for $ABC-xyz$, $\mathfrak{A}\mathfrak{B}\mathfrak{C}-\mathfrak{X}\mathfrak{Y}\mathfrak{Z}$, etc.

$$\backslash\mathrm{DeclareMathAlphabet}\{\langle cmd\rangle\}\langle NFSS\ decl.\rangle$$

51

`\DeclareSymbolFontAlphabet{<cmd>}{<name>}`

Alternative (and optimisation) for `\DeclareMathAlphabet` if a single font is being used for both alphabetic characters (as above) and symbols.

Maths ‘versions’ Different maths weights can be defined with the following, switched in text with the `\mathversion{<maths version>}` command.

`\SetSymbolFont{<name>}{<maths version>}{NFSS decl.}`

`\SetMathAlphabet{<cmd>}{<maths version>}{NFSS decl.}`

Maths symbols Symbol definitions in maths for both characters (=) and macros (`\eqdef`): `\DeclareMathSymbol{<symbol>}{<type>}{<named font>}{<slot>}` This is the macro that actually defines which font each symbol comes from and how they behave.

Delimiters and radicals use wrappers around \TeX ’s `\delimiter`/`\radical` primitives, which are re-designed in $\X_{\mathbb{E}}\TeX$. The syntax used in $\mathbb{E}\TeX$ ’s NFSS is therefore not so relevant here.

Delimiters A special class of maths symbol which enlarge themselves in certain contexts.

`\DeclareMathDelimiter{<symbol>}{<type>}{<sym. font>}{<slot>}{<sym. font>}{<slot>}`

Radicals Similar to delimiters (`\DeclareMathRadical` takes the same syntax) but behave ‘weirdly’. `\sqrt` might very well be the only one.

In those cases, glyph slots in *two* symbol fonts are required; one for the small (‘regular’) case, the other for situations when the glyph is larger. This is not the case in $\X_{\mathbb{E}}\TeX$.

Accents are not included yet.

A.2 Detailed code investigation

This section contains an abridged and documented version of (bits and pieces of) $\mathbb{E}\TeX$ ’s NFSS. Changes are mostly cosmetic and omission of irrelevant things.

A.3 Maths symbols

```
\DeclareMathSymbol #1 : Symbol, e.g., \alpha or ‘a’
#2 : Type, e.g., \mathalpha
#3 : Math font name, e.g., operators
#4 : Slot, e.g., F1
28 \def\DeclareMathSymbol#1#2#3#4{%
```

First ensure the math font (e.g., operators) exists:

```

29 \expandafter\in@\csname sym#3\expandafter\endcsname
30 \expandafter{\group@list}%
31 \ifin@

```

Convert the slot number to two hex digits stored in `\count\z@` and `\count\tw@`, respectively:

```

32 \begingroup
33 \count\z@=#4\relax
34 \count\tw@\count\z@
35 \divide\count\z@\sixt@@n
36 \count@\count\z@
37 \multiply\count@\sixt@@n
38 \advance\count\tw@-\count@

```

The symbol to be defined can be either a command (`\alpha`) or a character (`a`). Branch for the former:

```

39 \if\relax\noexpand#1% is command?
40 \edef\reserved@a{\noexpand\in@{\string\mathchar}{\meaning#1}}%
41 \reserved@a

```

If the symbol command definition contains `\mathchar`, then we can provide the info that a previous symbol definition is being overwritten:

```

42 \ifin@
43 \expandafter\set@mathsymbol
44 \csname sym#3\endcsname#1#2%
45 {\hexnumber@\count\z@}\hexnumber@\count\tw@}%
46 \@font@info{Redefining math symbol \string#1}%

```

Otherwise, throw an error if the command name is already taken by a non-symbol definition:

```

47 \else
48 \expandafter\ifx
49 \csname\expandafter\@gobble\string#1\endcsname
50 \relax
51 \expandafter\set@mathsymbol
52 \csname sym#3\endcsname#1#2%
53 {\hexnumber@\count\z@}\hexnumber@\count\tw@}%
54 \else
55 \@latex@error{Command '\string#1' already defined}\@eha
56 \fi
57 \fi

```

And if the symbol input is a character:

```

58 \else
59 \expandafter\set@mathchar
60 \csname sym#3\endcsname#1#2
61 {\hexnumber@\count\z@}\hexnumber@\count\tw@}%

```

```

62     \fi
63   \endgroup

```

Everything previous was skipped if the maths font doesn't exist in the first place:

```

64   \else
65     \@latex@error{Symbol font `#3' is not defined}\@eha
66   \fi}

```

The final macros that actually define the maths symbol with T_EX primitives. If the symbol definition is for a macro:

```

67 \def\set@mathsymbol#1#2#3#4{%
68   \global\mathchardef#2"\mathchar@type#3\hexnumber@#1#4\relax}

```

Or if it's for a character:

```

69 \def\set@mathchar#1#2#3#4{%
70   \global\mathcode`#2="\mathchar@type#3\hexnumber@#1#4\relax}

```

Summary For symbols, something like:

```

\def\DeclareMathSymbol#1#2#3#4{%
  \global\mathchardef#1"\mathchar@type#2
  \expandafter\hexnumber@\csname sym#2\endcsname
  {\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}}

```

For characters, something like:

```

\def\DeclareMathSymbol#1#2#3#4{%
  \global\mathcode`#1"\mathchar@type#2
  \expandafter\hexnumber@\csname sym#2\endcsname
  {\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}}

```

A.4 Delimiters

The code here is slightly better documented originally than the other maths commands.

`\DeclareMathDelimiter`

```

71 \def\DeclareMathDelimiter#1{%
72   \if\relax\noexpand#1%
73     \expandafter\@DeclareMathDelimiter
74   \else
75     \expandafter\@xxDeclareMathDelimiter
76   \fi
77   #1}
78 \@onlypreamble\DeclareMathDelimiter

```

`\@xxDeclareMathDelimiter` This macro checks if the second arg is a “math type” such as `\mathopen`. The undocumented original code didn’t use math types when the delimiter was a single letter. For this reason the coding is a bit strange as it tries to support the undocumented syntax for compatibility reasons.

```
79 \def\@xxDeclareMathDelimiter#1#2#3#4{%
```

7 is the default value returned in the case that `\mathchar@type` is passed something unexpected, like a math symbol font name. We locally move `\mathalpha` out of the way so if you use that the right branch is taken. This will still fail if an explicit number 7 is used!

```
80   \begingroup
81   \let\mathalpha\mathord
82   \ifnum7=\mathchar@type{#2}%
83   \endgroup
```

If this branch is taken we have old syntax (5 arguments).

```
84   \expandafter\@firstofone
85   \else
```

If this branch is taken `\mathchar@type` is different from 7 so we assume new syntax. In this case we also use the arguments to set up the letter as a math symbol for the case where it is not used as a delimiter.

```
86   \endgroup
87   \DeclareMathSymbol#1{#2}{#3}{#4}%
```

Then we arrange that `\@xDeclareMathDelimiter` only gets #1, #3, #4 ... as it does not expect a math type as argument.

```
88   \expandafter\@firstoftwo
89   \fi
90   {\@xDeclareMathDelimiter#1}{#2}{#3}{#4}}
91 \onlypreamble\@xxDeclareMathDelimiter
```

`\@DeclareMathDelimiter`

```
92 \def\@DeclareMathDelimiter#1#2#3#4#5#6{%
93   \expandafter\in@\csname sym#3\expandafter\endcsname
94   \expandafter{\group@list}%
95   \ifin@
96   \expandafter\in@\csname sym#5\expandafter\endcsname
97   \expandafter{\group@list}%
98   \ifin@
99   \begingroup
100    \count\z@=#4\relax
101    \count\tw@\count\z@
102    \divide\count\z@\sixt@@n
103    \count@\count\z@
104    \multiply\count@\sixt@@n
105    \advance\count\tw@-\count@
```

```

106 \edef\reserved@c{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
107 %
108 \count\z@=#6\relax
109 \count\tw@\count\z@
110 \divide\count\z@\sixt@n
111 \count@\count\z@
112 \multiply\count@\sixt@n
113 \advance\count\tw@-\count@
114 \edef\reserved@d{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
115 %
116 \edef\reserved@a{\noexpand\in@{\string\delimiter}{\meaning#1}}%
117 \reserved@a
118 \ifin@
119 \expandafter\set@mathdelimiter
120 \csname sym#3\expandafter\endcsname
121 \csname sym#5\endcsname#1#2%
122 \reserved@c\reserved@d
123 \@font@info{Redefining math delimiter \string#1}%
124 \else
125 \expandafter\ifx
126 \csname\expandafter\@gobble\string#1\endcsname
127 \relax
128 \expandafter\set@mathdelimiter
129 \csname sym#3\expandafter\endcsname
130 \csname sym#5\endcsname#1#2%
131 \reserved@c\reserved@d
132 \else
133 \@latex@error{Command ``\string#1' already defined}\@eha
134 \fi
135 \fi
136 \endgroup
137 \else
138 \@latex@error{Symbol font `#5' is not defined}\@eha
139 \fi
140 \else
141 \@latex@error{Symbol font `#3' is not defined}\@eha
142 \fi
143 }
144 \@onlypreamble\@DeclareMathDelimiter

```

\@xDeclareMathDelimiter

```

145 \def\@xDeclareMathDelimiter#1#2#3#4#5{%
146 \expandafter\in@\csname sym#2\expandafter\endcsname
147 \expandafter{\group@list}%
148 \ifin@
149 \expandafter\in@\csname sym#4\expandafter\endcsname
150 \expandafter{\group@list}%

```



```

151 \ifin@
152 \begingroup
153 \count\z@=#3\relax
154 \count\tw@\count\z@
155 \divide\count\z@\sixt@@n
156 \count@\count\z@
157 \multiply\count@\sixt@@n
158 \advance\count\tw@-\count@
159 \edef\reserved@c{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
160 %
161 \count\z@=#5\relax
162 \count\tw@\count\z@
163 \divide\count\z@\sixt@@n
164 \count@\count\z@
165 \multiply\count@\sixt@@n
166 \advance\count\tw@-\count@
167 \edef\reserved@d{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
168 \expandafter\set@mathdelimiter
169 \csname sym#2\expandafter\endcsname\csname sym#4\endcsname#1%
170 \reserved@c\reserved@d
171 \endgroup
172 \else
173 \@latex@error{Symbol font `#4' is not defined}\@eha
174 \fi
175 \else
176 \@latex@error{Symbol font `#2' is not defined}\@eha
177 \fi
178 }
179 \onlypreamble\@xDeclareMathDelimiter

```

`\set@mathdelimiter` We have to end the definition of a math delimiter like `\lfloor` with a space and not with `\relax` as we did before, because otherwise constructs involving `\abovewithdelims` will prematurely end (pr/1329)

```

180 \def\set@mathdelimiter#1#2#3#4#5#6{%
181 \xdef#3{\delimiter"\mathchar@type#4\hexnumber@#1#5%
182 \hexnumber@#2#6 }}
183 \onlypreamble\set@mathdelimiter

```

`\set@@mathdelimiter`

```

184 \def\set@@mathdelimiter#1#2#3#4#5{%
185 \global\delcode`#3="\hexnumber@#1#4\hexnumber@#2#5\relax}
186 \onlypreamble\set@@mathdelimiter

```

A.5 Symbol fonts

`\DeclareSymbolFont` #1 : font name, *e.g.*, letters

#2 : font encoding, *e.g.*, OT1

#3 : font family, *e.g.*, cmr

#4 : font series, *e.g.*, m

#5 : font shape, *e.g.*, n

```
187 \def\DeclareSymbolFont#1#2#3#4#5{%
```

First check that the font encoding is defined.

```
188 \@tempswafalse
```

```
189 \edef\reserved@b{#2}%
```

```
190 \def\cdp@elt##1##2##3##4{\def\reserved@c{##1}%
```

```
191     \ifx\reserved@b\reserved@c \@tempswatrue\fi}%
```

```
192 \cdp@list
```

So far so good. Now branch depending if this symbol font has been declared yet or not. If not, the symbol font is defined as the macro `\sym#1`; *i.e.*, for the letters symbol font, the associated command name is `\symletters`. (Funny it's not `\sym@#1`.)

```
193 \if@tempswa
```

```
194   \ifundefined{sym#1}{%
```

```
195     \expandafter\new@mathgroup\csname sym#1\endcsname
```

```
196     \expandafter\new@symbolfont\csname sym#1\endcsname{#2}{#3}{#4}{#5}%
```

```
197   }%
```

If the symbol font has been already declared:

```
198   {\@font@info{Redeclaring symbol font `#1'}%
```

[Update the group list.]

```
199     \def\group@elt##1##2{%
```

```
200       \noexpand\group@elt\noexpand##1%
```

```
201       \expandafter\ifx\csname sym#1\endcsname##1%
```

```
202       \expandafter\noexpand\csname#2/#3/#4/#5\endcsname
```

```
203     \else
```

```
204       \noexpand##2%
```

```
205     \fi}%
```

```
206 \xdef\group@list{\group@list}%
```

[Update the version list.]

```
207 \def\version@elt##1{%
```

```
208   \expandafter
```

```
209   \SetSymbolFont@expandafter##1\csname#2/#3/#4/#5\expandafter
```

```
210   \endcsname \csname sym#1\endcsname
```

```
211   }%
```

```
212 \version@list
```

```
213 }%
```

If the font encoding wasn't defined, all of the above was skipped.

```
214 \else
```

```
215   \@latex@error{Encoding scheme `#2' unknown}\@eha
```

```
216 \fi}
```

```

\new@symbolfont #1 : internal symbol font name, e.g., \symletters
#2 : font encoding, e.g., OT1
#3 : font family, e.g., cmr
#4 : font series, e.g., m
#5 : font shape, e.g., n
217 \def\new@symbolfont#1#2#3#4#5{%
Update the group list:
218 \toks@\expandafter{\group@list}%
219 \edef\group@list{\the\toks@\noexpand\group@elt\noexpand#1%
220 \expandafter\noexpand\csname#2/#3/#4/#5\endcsname}%
221 \def\version@elt##1{\toks@\expandafter{##1}%
222 \edef##1{\the\toks@\noexpand\getanddefine@fonts
223 #1\expandafter\noexpand\csname#2/#3/#4/#5\endcsname}%
224 \global\advance\csname c@\expandafter
225 \@gobble\string##1\endcsname\@ne
226 }%
227 \version@list}

\SetSymbolFont #1 : math font version, e.g., normal
#2 : font name, e.g., letters
#3 : font encoding, e.g., OT1
#4 : font family, e.g., cmr
#5 : font series, e.g., m
#6 : font shape, e.g., n
228 \def\SetSymbolFont#1#2#3#4#5#6{%
229 \@tempswafalse
230 \edef\reserved@b{#3}%
231 \def\cdp@elt##1##2##3##4{\def\reserved@c{##1}%
232 \ifx\reserved@b\reserved@c \@tempswatrue\fi}%
233 \cdp@list
234 \if@tempswa
235 \expandafter\SetSymbolFont@
236 \csname mv@#2\expandafter\endcsname\csname#3/#4/#5/#6\expandafter
237 \endcsname \csname sym#1\endcsname
238 \else
239 \@latex@error{Encoding scheme `#3' unknown}\@eha
240 \fi
241 }

\SetSymbolFont@ #1 : internal math font version, e.g., mv@normal
#2 : NFSS font, e.g., \OT1/cmr/m/n
#3 : internal symbol name, e.g., \symletters
242 \def\SetSymbolFont@#1#2#3{%

```

If the maths version has been defined:

```
243 \expandafter\in@\expandafter#1\expandafter{\version@list}%
244 \ifin@
```

If the symbol font has been defined:

```
245 \expandafter\in@\expandafter#3\expandafter{\group@list}%
246 \ifin@
247 \begingroup
248 \expandafter\get@cdp\string#2\@nil\reserved@a
249 \toks@{ }%
250 \def\install@mathalphabet##1##2{%
251 \addto@hook\toks@{\install@mathalphabet##1{##2}}%
252 }%
253 \def\getanddefine@fonts##1##2{%
254 \ifnum##1=#3%
255 \addto@hook\toks@{\getanddefine@fonts#3#2}%
256 \expandafter\get@cdp\string##2\@nil\reserved@b
257 \ifx\reserved@a\reserved@b\else
258 \@font@warning{Encoding '\reserved@b' has changed
259 to '\reserved@a' for symbol font\MessageBreak
260 '\expandafter\@gobblefour\string#3' in the
261 math version '\expandafter
262 \@gobblefour\string#1'}%
263 \fi
264 \@font@info{%
265 Overwriting symbol font
266 '\expandafter\@gobblefour\string#3' in
267 version '\expandafter
268 \@gobblefour\string#1'\MessageBreak
269 \@spaces \expandafter\@gobble\string##2 -->
270 \expandafter\@gobble\string#2}%
271 \else
272 \addto@hook\toks@{\getanddefine@fonts##1##2}%
273 \fi}%
274 #1%
275 \xdef#1{\the\toks@}%
276 \endgroup
```

If the symbol font wasn't defined, all of the above was skipped:

```
277 \else
278 \@latex@error{Symbol font '\expandafter\@gobblefour\string#3'
279 not defined}\@eha
280 \fi
```

If the maths version wasn't defined, all of the above was skipped:

```
281 \else
282 \@latex@error{Math version '\expandafter\@gobblefour\string#1'
283 is not
```

```
284         defined}{You probably misspelled the name of the math  
285         version.^^}Or you have to specify an additional package.}%  
286     \fi}
```