ALPHA BETA GAMMA delta epsilon zeta eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL

Experimental unicode mathematical typesetting: The unicode-math package

Will Robertson

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Contents

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 XeTeX, 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 XeTeX 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

`\setmathfont[`⟨*font features*⟩`]{`⟨*font name*⟩`}`

would implement this for every every symbol and alphabetic variant. That means `x` to x, `\xi` to ξ, `\leq` to $\leq$, etc., `\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:

`\setmathfont[Version=Bold,`⟨*font features*⟩`]{`⟨*font name*⟩`}`

Instances above of

`[`⟨*font features*⟩`]{`⟨*font name*⟩`}`

follow from my fontspec package, and therefore any additional ⟨*font features*⟩ 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:

`\setmathfont[Range=`⟨*unicode range*⟩`,`⟨*font features*⟩`]{`⟨*font name*⟩`}`

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 `MiscMathSymbolsA`, 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_{B_C}.

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.

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

3 Things we need

Packages

```
\RequirePackage{fontspec}
```

Counters and conditionals

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

Shortcuts

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

3.1 Programming macros

\um@Loop
\um@Break

See Kees van der Laan's various articles on TEX programming:

```
\def\um@Loop#1\um@Pool{#1\um@Loop#1\um@Pool}
\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.

```
\long\def\um@FOR #1 = [#2:#3] #4{%
   \csname#1\endcsname =#2\relax
   \um@Loop #4%
     \expandafter\advance\csname#1\endcsname\@ne
     \expandafter\ifnum\csname#1\endcsname>#3\relax
       \expandafter\um@Break
     \fi
   \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.

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

4 Fundamentals

4.1 Enlarging the number of maths families

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

```
\def\new@mathgroup{\alloc@8\mathgroup\chardef\@cclvi}
\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 LaTeX'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`

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

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

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

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

```
    \begingroup
```

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

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

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

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

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

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

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

```
         %\else
           %\expandafter\ifx
           %\csname\expandafter\@gobble\string#1\endcsname
           %\relax
             \expandafter\um@set@mathsymbol
                \csname sym#3\endcsname#1#2{#4}%
```

```
            %\else
            %  \@latex@error{Command `\string#1' already defined}\@eha
            %\fi
          %\fi
        \fi
```

And if the symbol input is a character:

```
      \else
        \expandafter\um@set@mathchar
          \csname sym#3\endcsname#1#2{#4}%
      \fi
    \endgroup
```

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

```
  \else
    \@latex@error{Symbol font `#3' is not defined}\@eha
  \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.

```
\def\um@set@mathsymbol#1#2#3#4{%
  \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 \⟨*cs*⟩`op` (where `#2` is \⟨*cs*⟩) and define \⟨*cs*⟩ as the wrapper around this control sequence.

```
  \expandafter\in@\expandafter#2\expandafter{\um@nolimits}%
  \ifin@
    \expandafter\global\expandafter\XeTeXmathchardef
      \csname\expandafter\@gobble\string#2 op\endcsname
      ="\mathchar@type#3 #1 #4\relax
    \gdef#2{\csname\expandafter\@gobble\string#2 op\endcsname\nolimits}%
  \else
```

Radicals

```
    \expandafter\in@\expandafter#2\expandafter{\um@radicals,}%
    \ifin@
      \gdef#2{\XeTeXradical#1 #4\relax}%
    \else
```

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

```
      \ifx\mathopen#3\relax
        \gdef#2{\XeTeXdelimiter "\mathchar@type#3 #1 #4}%
        \global\XeTeXdelcode#4=#1 #4\relax
        \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
      \else
        \ifx\mathclose#3\relax
          \gdef#2{\XeTeXdelimiter "\mathchar@type#3 #1 #4}%
          \global\XeTeXdelcode#4=#1 #4\relax
          \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
        \else
```

And finally, the general case. We define both the macro and the unicode mathcode; 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.

```
          \global\XeTeXmathchardef#2="\mathchar@type#3 #1 #4\relax
          \ifnum#4<"FFFF
            \global\XeTeXmathcode#4="\mathchar@type#3 #1 #4\relax
          \fi
        \fi
      \fi
    \fi
  \fi
  \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:

```
\def\um@set@mathchar#1#2#3#4{%
  \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{\infinity}{\mathord}{test}{"221E}
$\infinity$
```

`\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.

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

A

```
\zf@fontspec{}{Cambria Math}
\let\glb@currsize\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:

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

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

And an example of the `Range` feature:

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

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

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

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

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

```
\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}
\[
F(s)=\scrL\{f(t)\}=\int_0^\infty e^{-st}f(t)\,\upd t
\]
```

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

```
\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

```
\let\glb@currsize\relax
\let\um@char@range\@empty
\let\um@char@num@range\@empty
\stepcounter{um@fam}%
\@um@fontspec@featuretrue
\csname S@\f@size\endcsname
\def\um@mversion{normal}%
\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.

```
\zf@fontspec{
  Script=Math, SizeFeatures={
    {Size=\tf@size-},
    {Size=\sf@size-\tf@size,ScriptStyle={}},
    {Size=-\sf@size,ScriptScriptStyle={}}},
    #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!)

```
\edef\um@symfont{um@fam\theum@fam}%
\DeclareSymbolFont{\um@symfont}
    {\encodingdefault}{\zf@family}{\mddefault}{\updefault}%
\ifx\um@char@range\@empty
  \um@PackageInfo{Defining the default maths font as '#2'}%
  \let\UnicodeMathSymbol\um@mathsymbol@noparse
\else
  \let\UnicodeMathSymbol\um@mathsymbol@parse
\fi
```

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

```
\input unicode-math.tex
\input unicode-math-add.tex
```

```
\ifx\um@char@range\@empty
  \let\um@mathbb\@empty
  \let\um@mathbf\@empty
  \let\um@mathfrak\@empty
  \let\um@mathup\@empty
  \let\um@mathscr\@empty
  \let\um@mathsf\@empty
  \let\um@mathsfit\@empty
  \let\um@mathtt\@empty
  \let\um@mathbf\@empty
  \let\um@mathbfit\@empty
  \let\um@mathbffrak\@empty
  \let\um@mathbfscr\@empty
  \let\um@mathbfsf\@empty
  \let\um@mathbfsfit\@empty
  \let\MathAlphabetChar\um@mathmap@noparse
\else
  \let\MathAlphabetChar\um@mathmap@parse
\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):

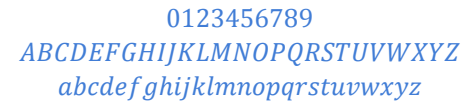
```
\ifx\um@char@range\@empty
\um@FOR @tempcnta = [0:9] {%
  \SetMathCode
    {\numexpr\the\@tempcnta+"30\relax}
    {\mathalpha}{\um@symfont}
    {\numexpr\the\@tempcnta+"30\relax}}%
```

Latin alphabet, uppercase and lowercase:

```
\um@FOR @tempcnta = [0:25] {%
    \SetMathCode
      {\numexpr\the\@tempcnta+`\A\relax}
      {\mathalpha}{\um@symfont}
      {\numexpr\the\@tempcnta+"1D434\relax}
    \SetMathCode
      {\numexpr\the\@tempcnta+`\a\relax}
      {\mathalpha}{\um@symfont}
      {\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):

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

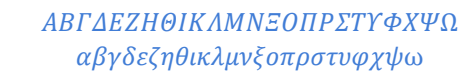



```
\setmathfont{Cambria Math}
$0123456789$ \\
$ABCDEFGHIJKLMNOPQRSTUVWXYZ$ \\
$abcdefghijklmnopqrstuvwxyz$ \\
```

Greek alphabet, italic uppercase and lowercase respectively:

```
\um@FOR @tempcnta = [0:23] {%
    \SetMathCode
      {\numexpr\the\@tempcnta+913\relax}
      {\mathalpha}{\um@symfont}
      {\numexpr\the\@tempcnta+"1D6E2\relax}
    \SetMathCode
      {\numexpr\the\@tempcnta+945\relax}
      {\mathalpha}{\um@symfont}
      {\numexpr\the\@tempcnta+"1D6FC\relax}}%
\fi
```

TODO: switches for upright Greek if desired.




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

Set up the maths alphabets:

```
  \input unicode-math-alphabets.tex
```

End of the `\setmathfont` macro.

```
}
```

`\um@mathsymbol@noparse`

```
\newcommand\um@mathsymbol@noparse[4]{
  \DeclareUnicodeMathSymbol
    {#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.

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

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

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

```
    \begingroup
      \csname um@math#1\endcsname
      ##1
    \endgroup}}
```

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

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

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

```
\um@mk@math{up}
\um@mk@math{scr}
\um@mk@math{bb}
\um@mk@math{frak}
\um@mk@math{sf}
\um@mk@math{sfit}
\um@mk@math{tt}
```

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

```
\um@mk@math{bf}
\um@mk@math{bfit}
\um@mk@math{bfscr}
\um@mk@math{bffrak}
\um@mk@math{bfsf}
\um@mk@math{bfsfit}
```

`\mathcal`

```
\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.

```
\newcommand\um@mathmap@noparse[3]{%
  \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`).

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

```
    \ifnum\@ii=#3\relax
     \expandafter\um@addto@mathmap\expandafter{\um@symfont}{#1}{#2}{#3}%
    \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.

```
\newcommand\um@addto@mathmap[4]{%
 \expandafter\g@addto@macro\csname um@\expandafter\@gobble\string#2\endcsname{%
   \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.*, `\def\int{\intop\nolimits}`, so there needs to be a transformation from `\int` to `\intop` during the expansion of `\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).

ALPHA BETA GAMMA delta epsilon zeta eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL

`\um@nolimits` This macro is a commalist containing those maths operators that require a `\nolimits` suffix. This list is used when processing `unicode-math.tex` to define such commands automatically (see the macro `\um@set@mathsymbol` on page 6). 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 ⨌, but that might be a matter of preference.

```
\def\um@nolimits{%
  \int,\iint,\iiint,\iiiint,\oint,\oiint,\oiiint,%
  \intclockwise,\varointclockwise,\ointctrclockwise,%
  \sumint,\intbar,\intBar,\fint,%
  \cirfnint,\awint,\rppolint,\scpolint,\npolint,\pointint,\sqint,%
  \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!

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

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

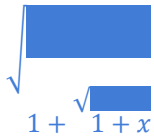
```
\setmathfont{Cambria Math}
\[ \int_0^1 \sum_0^N \left(\frac{%
   \left(\sum^N_{i=n}\left(\int^1_0
   \left(a\times b\right)
   \right)\right)}{A^{B^C}_{D_E}}\right) \]
```

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 comma-list.

```
\def\um@radicals{\sqrt}
```



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

4.7 Delimiters

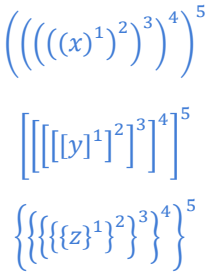
`\left` We redefine the primitive to be preceded by `\mathopen`; this gives much better spacing in cases such as `\sin\left`…. Courtesy of Frank Mittelbach:

`http://www.latex-project.org/cgi-bin/ltxbugs2html?pr=latex/3853&prlatex/3754`

```
\let\left@primitive\left
\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`



```
\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:

ALPHA BETA GAMMA delta epsilon zeta eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta

Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL

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

ALPHA BETA GAMMA delta epsilon zeta eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL Alpha Beta Gamma Delta Epsilon Zeta Eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega NABLA VAR SIGMA PARTIAL

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 UNDERBAR
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	⦘	\rblkbrbrak	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.

```
\newcommand\um@zf@feature[2]{%
  \define@key[zf]{options}{#1}{%
    \if@um@fontspec@feature
      #2
    \else
```

```
      \PackageError{fontspec/unicode-math}
        {The `#1' font feature can only be used for maths fonts}
        {The feature you tried to use can only be in commands
          like \protect\setmathfont}%
    \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.)

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

5.2 Range processing

```
\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 ≥ x
-y	r ≤ y
x-y	x ≤ r ≤ y

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

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

```
\newcommand\um@parse@term[4]{%
  \@for\@ii:=\um@char@range\do{%
```

```
    \unless\ifx\@ii\@empty
      \@tempswafalse
```

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

```
      \expandafter\if\expandafter\relax\expandafter\noexpand\@ii
        \expandafter\ifx\@ii#2
          \@tempswatrue
        \else
          \expandafter\ifx\@ii#3
            \@tempswatrue
          \fi
        \fi
```

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

```
      \else
        \expandafter\um@parse@range\@ii-\@marker-\@nil#1\@nil
      \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.

```
      \if@tempswa
        \ifx\um@char@num@range\@empty
          \g@addto@macro\um@char@num@range{#1}%
        \else
          \g@addto@macro\um@char@num@range{,#1}%
        \fi
        #4
      \fi
    \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}
   {`1' or `\string\a' or `\string\b' is included}
\um@parse@term{1}{\b}{\c}
   {`1' or `\string\b' or `\string\c' is included}
\um@parse@term{3}{\a}{\b}
   {`3' 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`.

```
\def\um@parse@range#1-#2-#3\@nil#4\@nil{%
  \def\@tempa{#1}%
  \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-{}

```
\ifx\@marker\@tempb\relax
  \ifnum#4=#1\relax
    \@tempswatrue
  \fi
\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-

```
  \ifx\@empty\@tempb
    \ifnum#4>\numexpr#1-1\relax
      \@tempswatrue
    \fi
  \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-

```
    \ifx\@empty\@tempa
      \ifnum#4<\numexpr#2+1\relax
        \@tempswatrue
      \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-

```
    \else
      \ifnum#4>\numexpr#1-1\relax
        \ifnum#4<\numexpr#2+1\relax
          \@tempswatrue
        \fi
      \fi
    \fi
  \fi
\fi}
```

5.3 Resolving Greek letters

TODO add switch for upright if desired.

```
\AtBeginDocument{\def\Alpha{\itAlpha}
\def\Beta{\itBeta}
\def\Gamma{\itGamma}
\def\Delta{\itDelta}
\def\Epsilon{\itEpsilon}
\def\Zeta{\itZeta}
\def\Eta{\itEta}
\def\Theta{\itTheta}
\def\Iota{\itIota}
\def\Kappa{\itKappa}
\def\Lambda{\itLambda}
\def\Mu{\itMu}
\def\Nu{\itNu}
\def\Xi{\itXi}
\def\Omicron{\itOmicron}
\def\Pi{\itPi}
\def\Rho{\itRho}
\def\varTheta{\itvarTheta}
\def\Sigma{\itSigma}
\def\Tau{\itTau}
\def\Upsilon{\itUpsilon}
\def\Phi{\itPhi}
\def\Chi{\itChi}
\def\Psi{\itPsi}
\def\Omega{\itOmega}
\def\nabla{\itnabla}
\def\alpha{\italpha}
\def\beta{\itbeta}
\def\gamma{\itgamma}
\def\delta{\itdelta}
\def\varepsilon{\itvarepsilon}
\def\zeta{\itzeta}
\def\eta{\iteta}
\def\theta{\ittheta}
\def\iota{\itiota}
\def\kappa{\itkappa}
\def\lambda{\itlambda}
\def\mu{\itmu}
\def\nu{\itnu}
\def\xi{\itxi}
\def\omicron{\itomicron}
\def\pi{\itpi}
\def\rho{\itrho}
\def\varsigma{\itvarsigma}
\def\sigma{\itsigma}
\def\tau{\ittau}
```

```
\def\upsilon{\itupsilon}
\def\phi{\itphi}
\def\chi{\itchi}
\def\psi{\itpsi}
\def\omega{\itomega}
\def\partial{\uppartial}
\def\varepsilon{\itvarepsilon}
\def\vartheta{\itvartheta}
\def\varkappa{\itvarkappa}
\def\varphi{\itvarphi}
\def\varrho{\itvarrho}
\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
abcdefghijklmnopqrstuvwxyz
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ
αβγδεζηθικλμνξοπρστυφχψω

```
\setmathfont{Cambria Math}
$\mathup{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathup{abcdefghijklmnopqrstuvwxyz}$ \\
$\mathup{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \\
$\mathup{αβγδεζηθικλμνξοπρστυφχψω}$ \\
```

Roman uppercase:

```
\MathAlphabetChar{\mathup}{`\A}{`\A}%
\MathAlphabetChar{\mathup}{`\B}{`\B}%
\MathAlphabetChar{\mathup}{`\C}{`\C}%
\MathAlphabetChar{\mathup}{`\D}{`\D}%
\MathAlphabetChar{\mathup}{`\E}{`\E}%
\MathAlphabetChar{\mathup}{`\F}{`\F}%
\MathAlphabetChar{\mathup}{`\G}{`\G}%
\MathAlphabetChar{\mathup}{`\H}{`\H}%
\MathAlphabetChar{\mathup}{`\I}{`\I}%
\MathAlphabetChar{\mathup}{`\J}{`\J}%
\MathAlphabetChar{\mathup}{`\K}{`\K}%
\MathAlphabetChar{\mathup}{`\L}{`\L}%
\MathAlphabetChar{\mathup}{`\M}{`\M}%
```

```
\MathAlphabetChar{\mathup}{`\N}{`\N}%
\MathAlphabetChar{\mathup}{`\O}{`\O}%
\MathAlphabetChar{\mathup}{`\P}{`\P}%
\MathAlphabetChar{\mathup}{`\Q}{`\Q}%
\MathAlphabetChar{\mathup}{`\R}{`\R}%
\MathAlphabetChar{\mathup}{`\S}{`\S}%
\MathAlphabetChar{\mathup}{`\T}{`\T}%
\MathAlphabetChar{\mathup}{`\U}{`\U}%
\MathAlphabetChar{\mathup}{`\V}{`\V}%
\MathAlphabetChar{\mathup}{`\W}{`\W}%
\MathAlphabetChar{\mathup}{`\X}{`\X}%
\MathAlphabetChar{\mathup}{`\Y}{`\Y}%
\MathAlphabetChar{\mathup}{`\Z}{`\Z}%
```

Roman lowercase:

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

Greek uppercase:

```
\MathAlphabetChar{\mathup}{913}{913}%
\MathAlphabetChar{\mathup}{914}{914}%
\MathAlphabetChar{\mathup}{915}{915}%
\MathAlphabetChar{\mathup}{916}{916}%
\MathAlphabetChar{\mathup}{917}{917}%
```

```
\MathAlphabetChar{\mathup}{918}{918}%
\MathAlphabetChar{\mathup}{919}{919}%
\MathAlphabetChar{\mathup}{920}{920}%
\MathAlphabetChar{\mathup}{921}{921}%
\MathAlphabetChar{\mathup}{922}{922}%
\MathAlphabetChar{\mathup}{923}{923}%
\MathAlphabetChar{\mathup}{924}{924}%
\MathAlphabetChar{\mathup}{925}{925}%
\MathAlphabetChar{\mathup}{926}{926}%
\MathAlphabetChar{\mathup}{927}{927}%
\MathAlphabetChar{\mathup}{928}{928}%
\MathAlphabetChar{\mathup}{929}{929}%
\MathAlphabetChar{\mathup}{930}{930}%
\MathAlphabetChar{\mathup}{931}{931}%
\MathAlphabetChar{\mathup}{932}{932}%
\MathAlphabetChar{\mathup}{933}{933}%
\MathAlphabetChar{\mathup}{934}{934}%
\MathAlphabetChar{\mathup}{935}{935}%
\MathAlphabetChar{\mathup}{936}{936}%
```

Greek lowercase:

```
\MathAlphabetChar{\mathup}{945}{945}%
\MathAlphabetChar{\mathup}{946}{946}%
\MathAlphabetChar{\mathup}{947}{947}%
\MathAlphabetChar{\mathup}{948}{948}%
\MathAlphabetChar{\mathup}{949}{949}%
\MathAlphabetChar{\mathup}{950}{950}%
\MathAlphabetChar{\mathup}{951}{951}%
\MathAlphabetChar{\mathup}{952}{952}%
\MathAlphabetChar{\mathup}{953}{953}%
\MathAlphabetChar{\mathup}{954}{954}%
\MathAlphabetChar{\mathup}{955}{955}%
\MathAlphabetChar{\mathup}{956}{956}%
\MathAlphabetChar{\mathup}{957}{957}%
\MathAlphabetChar{\mathup}{958}{958}%
\MathAlphabetChar{\mathup}{959}{959}%
\MathAlphabetChar{\mathup}{960}{960}%
\MathAlphabetChar{\mathup}{961}{961}%
\MathAlphabetChar{\mathup}{962}{962}%
\MathAlphabetChar{\mathup}{963}{963}%
\MathAlphabetChar{\mathup}{964}{964}%
\MathAlphabetChar{\mathup}{965}{965}%
\MathAlphabetChar{\mathup}{966}{966}%
\MathAlphabetChar{\mathup}{967}{967}%
\MathAlphabetChar{\mathup}{968}{968}%
```

TODO: nabla and others

5.3.2 Blackboard or double-struck: `\mathbb`


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

Numbers: (always upright)

```
\MathAlphabetChar{\mathbb}{`\0}{"1D7D8}%
\MathAlphabetChar{\mathbb}{`\1}{"1D7D9}%
\MathAlphabetChar{\mathbb}{`\2}{"1D7DA}%
\MathAlphabetChar{\mathbb}{`\3}{"1D7DB}%
\MathAlphabetChar{\mathbb}{`\4}{"1D7DC}%
\MathAlphabetChar{\mathbb}{`\5}{"1D7DD}%
\MathAlphabetChar{\mathbb}{`\6}{"1D7DE}%
\MathAlphabetChar{\mathbb}{`\7}{"1D7DF}%
\MathAlphabetChar{\mathbb}{`\8}{"1D7E0}%
\MathAlphabetChar{\mathbb}{`\9}{"1D7E1}%
```

Letters:

```
\MathAlphabetChar{\mathbb}{`\A}{"1D538}%
\MathAlphabetChar{\mathbb}{`\B}{"1D539}%
\MathAlphabetChar{\mathbb}{`\C}{"2102}%
\MathAlphabetChar{\mathbb}{`\D}{"1D53B}%
\MathAlphabetChar{\mathbb}{`\E}{"1D53C}%
\MathAlphabetChar{\mathbb}{`\F}{"1D53D}%
\MathAlphabetChar{\mathbb}{`\G}{"1D53E}%
\MathAlphabetChar{\mathbb}{`\H}{"210D}%
\MathAlphabetChar{\mathbb}{`\I}{"1D540}%
\MathAlphabetChar{\mathbb}{`\J}{"1D541}%
\MathAlphabetChar{\mathbb}{`\K}{"1D542}%
\MathAlphabetChar{\mathbb}{`\L}{"1D543}%
\MathAlphabetChar{\mathbb}{`\M}{"1D544}%
\MathAlphabetChar{\mathbb}{`\N}{"2115}%
\MathAlphabetChar{\mathbb}{`\O}{"1D546}%
\MathAlphabetChar{\mathbb}{`\P}{"2119}%
\MathAlphabetChar{\mathbb}{`\Q}{"211A}%
\MathAlphabetChar{\mathbb}{`\R}{"211D}%
\MathAlphabetChar{\mathbb}{`\S}{"1D54A}%
\MathAlphabetChar{\mathbb}{`\T}{"1D54B}%
\MathAlphabetChar{\mathbb}{`\U}{"1D54C}%
\MathAlphabetChar{\mathbb}{`\V}{"1D54D}%
\MathAlphabetChar{\mathbb}{`\W}{"1D54E}%
\MathAlphabetChar{\mathbb}{`\X}{"1D54F}%
\MathAlphabetChar{\mathbb}{`\Y}{"1D550}%
\MathAlphabetChar{\mathbb}{`\Z} {"2124}%
```

Roman lowercase:

```
\MathAlphabetChar{\mathbb}{`\a}{"1D552}%
\MathAlphabetChar{\mathbb}{`\b}{"1D553}%
\MathAlphabetChar{\mathbb}{`\c}{"1D554}%
\MathAlphabetChar{\mathbb}{`\d}{"1D555}%
\MathAlphabetChar{\mathbb}{`\e}{"1D556}%
\MathAlphabetChar{\mathbb}{`\f}{"1D557}%
\MathAlphabetChar{\mathbb}{`\g}{"1D558}%
\MathAlphabetChar{\mathbb}{`\h}{"1D559}%
\MathAlphabetChar{\mathbb}{`\i}{"1D55A}%
\MathAlphabetChar{\mathbb}{`\j}{"1D55B}%
\MathAlphabetChar{\mathbb}{`\k}{"1D55C}%
\MathAlphabetChar{\mathbb}{`\l}{"1D55D}%
\MathAlphabetChar{\mathbb}{`\m}{"1D55E}%
\MathAlphabetChar{\mathbb}{`\n}{"1D55F}%
\MathAlphabetChar{\mathbb}{`\o}{"1D560}%
\MathAlphabetChar{\mathbb}{`\p}{"1D561}%
\MathAlphabetChar{\mathbb}{`\q}{"1D562}%
\MathAlphabetChar{\mathbb}{`\r}{"1D563}%
\MathAlphabetChar{\mathbb}{`\s}{"1D564}%
\MathAlphabetChar{\mathbb}{`\t}{"1D565}%
\MathAlphabetChar{\mathbb}{`\u}{"1D566}%
\MathAlphabetChar{\mathbb}{`\v}{"1D567}%
\MathAlphabetChar{\mathbb}{`\w}{"1D568}%
\MathAlphabetChar{\mathbb}{`\x}{"1D569}%
\MathAlphabetChar{\mathbb}{`\y}{"1D56A}%
\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

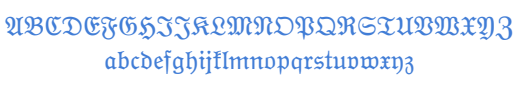
```
\setmathfont{Cambria Math}
$\mathscr{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathscr{abcdefghijklmnopqrstuvwxyz}$ \\
```

```
\MathAlphabetChar{\mathscr}{`\A}{"1D49C}%
\MathAlphabetChar{\mathscr}{`\B}{8492}%
\MathAlphabetChar{\mathscr}{`\C}{119966}%
\MathAlphabetChar{\mathscr}{`\D}{119967}%
\MathAlphabetChar{\mathscr}{`\E}{8496}%
\MathAlphabetChar{\mathscr}{`\F}{8497}%
\MathAlphabetChar{\mathscr}{`\G}{119970}%
\MathAlphabetChar{\mathscr}{`\H}{8459}%
\MathAlphabetChar{\mathscr}{`\I}{8464}%
```

```
\MathAlphabetChar{\mathscr}{`\J}{119973}%
\MathAlphabetChar{\mathscr}{`\K}{119974}%
\MathAlphabetChar{\mathscr}{`\L}{8466}%
\MathAlphabetChar{\mathscr}{`\M}{8499}%
\MathAlphabetChar{\mathscr}{`\N}{119977}%
\MathAlphabetChar{\mathscr}{`\O}{119978}%
\MathAlphabetChar{\mathscr}{`\P}{119979}%
\MathAlphabetChar{\mathscr}{`\Q}{119980}%
\MathAlphabetChar{\mathscr}{`\R}{8475}%
\MathAlphabetChar{\mathscr}{`\S}{119982}%
\MathAlphabetChar{\mathscr}{`\T}{119983}%
\MathAlphabetChar{\mathscr}{`\U}{119984}%
\MathAlphabetChar{\mathscr}{`\V}{119985}%
\MathAlphabetChar{\mathscr}{`\W}{119986}%
\MathAlphabetChar{\mathscr}{`\X}{119987}%
\MathAlphabetChar{\mathscr}{`\Y}{119988}%
\MathAlphabetChar{\mathscr}{`\Z}{119989}%

\MathAlphabetChar{\mathscr}{`\a}{"1D4B6}%
\MathAlphabetChar{\mathscr}{`\b}{"1D4B7}%
\MathAlphabetChar{\mathscr}{`\c}{"1D4B8}%
\MathAlphabetChar{\mathscr}{`\d}{"1D4B9}%
\MathAlphabetChar{\mathscr}{`\e}{"212F}%
\MathAlphabetChar{\mathscr}{`\f}{"1D4BB}%
\MathAlphabetChar{\mathscr}{`\g}{"210A}%
\MathAlphabetChar{\mathscr}{`\h}{"1D4BD}%
\MathAlphabetChar{\mathscr}{`\i}{"1D4BE}%
\MathAlphabetChar{\mathscr}{`\j}{"1D4BF}%
\MathAlphabetChar{\mathscr}{`\k}{"1D4C0}%
\MathAlphabetChar{\mathscr}{`\l}{"1D4C1}%
\MathAlphabetChar{\mathscr}{`\m}{"1D4C2}%
\MathAlphabetChar{\mathscr}{`\n}{"1D4C3}%
\MathAlphabetChar{\mathscr}{`\o}{"2134}%
\MathAlphabetChar{\mathscr}{`\p}{"1D4C5}%
\MathAlphabetChar{\mathscr}{`\q}{"1D4C6}%
\MathAlphabetChar{\mathscr}{`\r}{"1D4C7}%
\MathAlphabetChar{\mathscr}{`\s}{"1D4C8}%
\MathAlphabetChar{\mathscr}{`\t}{"1D4C9}%
\MathAlphabetChar{\mathscr}{`\u}{"1D4CA}%
\MathAlphabetChar{\mathscr}{`\v}{"1D4CB}%
\MathAlphabetChar{\mathscr}{`\w}{"1D4CC}%
\MathAlphabetChar{\mathscr}{`\x}{"1D4CD}%
\MathAlphabetChar{\mathscr}{`\y}{"1D4CE}%
\MathAlphabetChar{\mathscr}{`\z}{"1D4CF}%
```

5.3.4 Fractur or fraktur or blackletter: `\mathfrak`




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

Letters, with exceptions $\{\mathfrak{C}, \mathfrak{H}, \mathfrak{I}, \mathfrak{R}, \mathfrak{Z}\}$:

```
\MathAlphabetChar{\mathfrak}{`\A}{"1D504}%
\MathAlphabetChar{\mathfrak}{`\B}{"1D505}%
\MathAlphabetChar{\mathfrak}{`\C}{"212D}%
\MathAlphabetChar{\mathfrak}{`\D}{"1D507}%
\MathAlphabetChar{\mathfrak}{`\E}{"1D508}%
\MathAlphabetChar{\mathfrak}{`\F}{"1D509}%
\MathAlphabetChar{\mathfrak}{`\G}{"1D50A}%
\MathAlphabetChar{\mathfrak}{`\H}{"210C}%
\MathAlphabetChar{\mathfrak}{`\I}{"2111}%
\MathAlphabetChar{\mathfrak}{`\J}{"1D50D}%
\MathAlphabetChar{\mathfrak}{`\K}{"1D50E}%
\MathAlphabetChar{\mathfrak}{`\L}{"1D50F}%
\MathAlphabetChar{\mathfrak}{`\M}{"1D510}%
\MathAlphabetChar{\mathfrak}{`\N}{"1D511}%
\MathAlphabetChar{\mathfrak}{`\O}{"1D512}%
\MathAlphabetChar{\mathfrak}{`\P}{"1D513}%
\MathAlphabetChar{\mathfrak}{`\Q}{"1D514}%
\MathAlphabetChar{\mathfrak}{`\R}{"211C}%
\MathAlphabetChar{\mathfrak}{`\S}{"1D516}%
\MathAlphabetChar{\mathfrak}{`\T}{"1D517}%
\MathAlphabetChar{\mathfrak}{`\U}{"1D518}%
\MathAlphabetChar{\mathfrak}{`\V}{"1D519}%
\MathAlphabetChar{\mathfrak}{`\W}{"1D51A}%
\MathAlphabetChar{\mathfrak}{`\X}{"1D51B}%
\MathAlphabetChar{\mathfrak}{`\Y}{"1D51C}%
\MathAlphabetChar{\mathfrak}{`\Z}{"2128}%

\MathAlphabetChar{\mathfrak}{`\a}{"1D51E}%
\MathAlphabetChar{\mathfrak}{`\b}{"1D51F}%
\MathAlphabetChar{\mathfrak}{`\c}{"1D520}%
\MathAlphabetChar{\mathfrak}{`\d}{"1D521}%
\MathAlphabetChar{\mathfrak}{`\e}{"1D522}%
\MathAlphabetChar{\mathfrak}{`\f}{"1D523}%
\MathAlphabetChar{\mathfrak}{`\g}{"1D524}%
\MathAlphabetChar{\mathfrak}{`\h}{"1D525}%
\MathAlphabetChar{\mathfrak}{`\i}{"1D526}%
\MathAlphabetChar{\mathfrak}{`\j}{"1D527}%
\MathAlphabetChar{\mathfrak}{`\k}{"1D528}%
\MathAlphabetChar{\mathfrak}{`\l}{"1D529}%
```

```
\MathAlphabetChar{\mathfrak}{`\m}{"1D52A}%
\MathAlphabetChar{\mathfrak}{`\n}{"1D52B}%
\MathAlphabetChar{\mathfrak}{`\o}{"1D52C}%
\MathAlphabetChar{\mathfrak}{`\p}{"1D52D}%
\MathAlphabetChar{\mathfrak}{`\q}{"1D52E}%
\MathAlphabetChar{\mathfrak}{`\r}{"1D52F}%
\MathAlphabetChar{\mathfrak}{`\s}{"1D530}%
\MathAlphabetChar{\mathfrak}{`\t}{"1D531}%
\MathAlphabetChar{\mathfrak}{`\u}{"1D532}%
\MathAlphabetChar{\mathfrak}{`\v}{"1D533}%
\MathAlphabetChar{\mathfrak}{`\w}{"1D534}%
\MathAlphabetChar{\mathfrak}{`\x}{"1D535}%
\MathAlphabetChar{\mathfrak}{`\y}{"1D536}%
\MathAlphabetChar{\mathfrak}{`\z}{"1D537}%
```

5.3.5 Sans serif: `\mathsf`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

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

Numbers:

```
\MathAlphabetChar{\mathsf}{`\0}{"1D7E2}%
\MathAlphabetChar{\mathsf}{`\1}{"1D7E3}%
\MathAlphabetChar{\mathsf}{`\2}{"1D7E4}%
\MathAlphabetChar{\mathsf}{`\3}{"1D7E5}%
\MathAlphabetChar{\mathsf}{`\4}{"1D7E6}%
\MathAlphabetChar{\mathsf}{`\5}{"1D7E7}%
\MathAlphabetChar{\mathsf}{`\6}{"1D7E8}%
\MathAlphabetChar{\mathsf}{`\7}{"1D7E9}%
\MathAlphabetChar{\mathsf}{`\8}{"1D7EA}%
\MathAlphabetChar{\mathsf}{`\9}{"1D7EB}%
```

Roman letters:

```
\MathAlphabetChar{\mathsf}{`\A}{"1D5A0}%
\MathAlphabetChar{\mathsf}{`\B}{"1D5A1}%
\MathAlphabetChar{\mathsf}{`\C}{"1D5A2}%
\MathAlphabetChar{\mathsf}{`\D}{"1D5A3}%
\MathAlphabetChar{\mathsf}{`\E}{"1D5A4}%
\MathAlphabetChar{\mathsf}{`\F}{"1D5A5}%
\MathAlphabetChar{\mathsf}{`\G}{"1D5A6}%
\MathAlphabetChar{\mathsf}{`\H}{"1D5A7}%
\MathAlphabetChar{\mathsf}{`\I}{"1D5A8}%
\MathAlphabetChar{\mathsf}{`\J}{"1D5A9}%
\MathAlphabetChar{\mathsf}{`\K}{"1D5AA}%
```

```
\MathAlphabetChar{\mathsf}{`\L}{"1D5AB}%
\MathAlphabetChar{\mathsf}{`\M}{"1D5AC}%
\MathAlphabetChar{\mathsf}{`\N}{"1D5AD}%
\MathAlphabetChar{\mathsf}{`\O}{"1D5AE}%
\MathAlphabetChar{\mathsf}{`\P}{"1D5AF}%
\MathAlphabetChar{\mathsf}{`\Q}{"1D5B0}%
\MathAlphabetChar{\mathsf}{`\R}{"1D5B1}%
\MathAlphabetChar{\mathsf}{`\S}{"1D5B2}%
\MathAlphabetChar{\mathsf}{`\T}{"1D5B3}%
\MathAlphabetChar{\mathsf}{`\U}{"1D5B4}%
\MathAlphabetChar{\mathsf}{`\V}{"1D5B5}%
\MathAlphabetChar{\mathsf}{`\W}{"1D5B6}%
\MathAlphabetChar{\mathsf}{`\X}{"1D5B7}%
\MathAlphabetChar{\mathsf}{`\Y}{"1D5B8}%
\MathAlphabetChar{\mathsf}{`\Z}{"1D5B9}%

\MathAlphabetChar{\mathsf}{`\a}{"1D5BA}%
\MathAlphabetChar{\mathsf}{`\b}{"1D5BB}%
\MathAlphabetChar{\mathsf}{`\c}{"1D5BC}%
\MathAlphabetChar{\mathsf}{`\d}{"1D5BD}%
\MathAlphabetChar{\mathsf}{`\e}{"1D5BE}%
\MathAlphabetChar{\mathsf}{`\f}{"1D5BF}%
\MathAlphabetChar{\mathsf}{`\g}{"1D5C0}%
\MathAlphabetChar{\mathsf}{`\h}{"1D5C1}%
\MathAlphabetChar{\mathsf}{`\i}{"1D5C2}%
\MathAlphabetChar{\mathsf}{`\j}{"1D5C3}%
\MathAlphabetChar{\mathsf}{`\k}{"1D5C4}%
\MathAlphabetChar{\mathsf}{`\l}{"1D5C5}%
\MathAlphabetChar{\mathsf}{`\m}{"1D5C6}%
\MathAlphabetChar{\mathsf}{`\n}{"1D5C7}%
\MathAlphabetChar{\mathsf}{`\o}{"1D5C8}%
\MathAlphabetChar{\mathsf}{`\p}{"1D5C9}%
\MathAlphabetChar{\mathsf}{`\q}{"1D5CA}%
\MathAlphabetChar{\mathsf}{`\r}{"1D5CB}%
\MathAlphabetChar{\mathsf}{`\s}{"1D5CC}%
\MathAlphabetChar{\mathsf}{`\t}{"1D5CD}%
\MathAlphabetChar{\mathsf}{`\u}{"1D5CE}%
\MathAlphabetChar{\mathsf}{`\v}{"1D5CF}%
\MathAlphabetChar{\mathsf}{`\w}{"1D5D0}%
\MathAlphabetChar{\mathsf}{`\x}{"1D5D1}%
\MathAlphabetChar{\mathsf}{`\y}{"1D5D2}%
\MathAlphabetChar{\mathsf}{`\z}{"1D5D3}%
```

5.3.6 Sans serif italic: `\mathsfit`


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

Numbers (always upright):

```
\MathAlphabetChar{\mathsfit}{`\0}{"1D7E2}%
\MathAlphabetChar{\mathsfit}{`\1}{"1D7E3}%
\MathAlphabetChar{\mathsfit}{`\2}{"1D7E4}%
\MathAlphabetChar{\mathsfit}{`\3}{"1D7E5}%
\MathAlphabetChar{\mathsfit}{`\4}{"1D7E6}%
\MathAlphabetChar{\mathsfit}{`\5}{"1D7E7}%
\MathAlphabetChar{\mathsfit}{`\6}{"1D7E8}%
\MathAlphabetChar{\mathsfit}{`\7}{"1D7E9}%
\MathAlphabetChar{\mathsfit}{`\8}{"1D7EA}%
\MathAlphabetChar{\mathsfit}{`\9}{"1D7EB}%
```

Roman letters:

```
\MathAlphabetChar{\mathsfit}{`\A}{"1D608}%
\MathAlphabetChar{\mathsfit}{`\B}{"1D609}%
\MathAlphabetChar{\mathsfit}{`\C}{"1D60A}%
\MathAlphabetChar{\mathsfit}{`\D}{"1D60B}%
\MathAlphabetChar{\mathsfit}{`\E}{"1D60C}%
\MathAlphabetChar{\mathsfit}{`\F}{"1D60D}%
\MathAlphabetChar{\mathsfit}{`\G}{"1D60E}%
\MathAlphabetChar{\mathsfit}{`\H}{"1D60F}%
\MathAlphabetChar{\mathsfit}{`\I}{"1D610}%
\MathAlphabetChar{\mathsfit}{`\J}{"1D611}%
\MathAlphabetChar{\mathsfit}{`\K}{"1D612}%
\MathAlphabetChar{\mathsfit}{`\L}{"1D613}%
\MathAlphabetChar{\mathsfit}{`\M}{"1D614}%
\MathAlphabetChar{\mathsfit}{`\N}{"1D615}%
\MathAlphabetChar{\mathsfit}{`\O}{"1D616}%
\MathAlphabetChar{\mathsfit}{`\P}{"1D617}%
\MathAlphabetChar{\mathsfit}{`\Q}{"1D618}%
\MathAlphabetChar{\mathsfit}{`\R}{"1D619}%
\MathAlphabetChar{\mathsfit}{`\S}{"1D61A}%
\MathAlphabetChar{\mathsfit}{`\T}{"1D61B}%
\MathAlphabetChar{\mathsfit}{`\U}{"1D61C}%
\MathAlphabetChar{\mathsfit}{`\V}{"1D61D}%
\MathAlphabetChar{\mathsfit}{`\W}{"1D61E}%
\MathAlphabetChar{\mathsfit}{`\X}{"1D61F}%
\MathAlphabetChar{\mathsfit}{`\Y}{"1D620}%
\MathAlphabetChar{\mathsfit}{`\Z}{"1D621}%
```

```
\MathAlphabetChar{\mathsfit}{`\a}{"1D622}%
\MathAlphabetChar{\mathsfit}{`\b}{"1D623}%
\MathAlphabetChar{\mathsfit}{`\c}{"1D624}%
\MathAlphabetChar{\mathsfit}{`\d}{"1D625}%
\MathAlphabetChar{\mathsfit}{`\e}{"1D626}%
\MathAlphabetChar{\mathsfit}{`\f}{"1D627}%
\MathAlphabetChar{\mathsfit}{`\g}{"1D628}%
\MathAlphabetChar{\mathsfit}{`\h}{"1D629}%
\MathAlphabetChar{\mathsfit}{`\i}{"1D62A}%
\MathAlphabetChar{\mathsfit}{`\j}{"1D62B}%
\MathAlphabetChar{\mathsfit}{`\k}{"1D62C}%
\MathAlphabetChar{\mathsfit}{`\l}{"1D62D}%
\MathAlphabetChar{\mathsfit}{`\m}{"1D62E}%
\MathAlphabetChar{\mathsfit}{`\n}{"1D62F}%
\MathAlphabetChar{\mathsfit}{`\o}{"1D630}%
\MathAlphabetChar{\mathsfit}{`\p}{"1D631}%
\MathAlphabetChar{\mathsfit}{`\q}{"1D632}%
\MathAlphabetChar{\mathsfit}{`\r}{"1D633}%
\MathAlphabetChar{\mathsfit}{`\s}{"1D634}%
\MathAlphabetChar{\mathsfit}{`\t}{"1D635}%
\MathAlphabetChar{\mathsfit}{`\u}{"1D636}%
\MathAlphabetChar{\mathsfit}{`\v}{"1D637}%
\MathAlphabetChar{\mathsfit}{`\w}{"1D638}%
\MathAlphabetChar{\mathsfit}{`\x}{"1D639}%
\MathAlphabetChar{\mathsfit}{`\y}{"1D63A}%
\MathAlphabetChar{\mathsfit}{`\z}{"1D63B}%
```

5.3.7 Typewriter or monospaced: `\mathtt`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

```
\setmathfont{Code2001}% ugly
$\mathtt{0123456789}$ \\
$\mathtt{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathtt{abcdefghijklmnopqrstuvwxyz}$ \\
```

Numbers:

```
\MathAlphabetChar{\mathtt}{`\0}{"1D7F6}%
\MathAlphabetChar{\mathtt}{`\1}{"1D7F7}%
\MathAlphabetChar{\mathtt}{`\2}{"1D7F8}%
\MathAlphabetChar{\mathtt}{`\3}{"1D7F9}%
\MathAlphabetChar{\mathtt}{`\4}{"1D7FA}%
\MathAlphabetChar{\mathtt}{`\5}{"1D7FB}%
\MathAlphabetChar{\mathtt}{`\6}{"1D7FC}%
\MathAlphabetChar{\mathtt}{`\7}{"1D7FD}%
\MathAlphabetChar{\mathtt}{`\8}{"1D7FE}%
\MathAlphabetChar{\mathtt}{`\9}{"1D7FF}%
```

Letters:

```
\MathAlphabetChar{\mathtt}{`\A}{"1D670}%
\MathAlphabetChar{\mathtt}{`\B}{"1D671}%
\MathAlphabetChar{\mathtt}{`\C}{"1D672}%
\MathAlphabetChar{\mathtt}{`\D}{"1D673}%
\MathAlphabetChar{\mathtt}{`\E}{"1D674}%
\MathAlphabetChar{\mathtt}{`\F}{"1D675}%
\MathAlphabetChar{\mathtt}{`\G}{"1D676}%
\MathAlphabetChar{\mathtt}{`\H}{"1D677}%
\MathAlphabetChar{\mathtt}{`\I}{"1D678}%
\MathAlphabetChar{\mathtt}{`\J}{"1D679}%
\MathAlphabetChar{\mathtt}{`\K}{"1D67A}%
\MathAlphabetChar{\mathtt}{`\L}{"1D67B}%
\MathAlphabetChar{\mathtt}{`\M}{"1D67C}%
\MathAlphabetChar{\mathtt}{`\N}{"1D67D}%
\MathAlphabetChar{\mathtt}{`\O}{"1D67E}%
\MathAlphabetChar{\mathtt}{`\P}{"1D67F}%
\MathAlphabetChar{\mathtt}{`\Q}{"1D680}%
\MathAlphabetChar{\mathtt}{`\R}{"1D681}%
\MathAlphabetChar{\mathtt}{`\S}{"1D682}%
\MathAlphabetChar{\mathtt}{`\T}{"1D683}%
\MathAlphabetChar{\mathtt}{`\U}{"1D684}%
\MathAlphabetChar{\mathtt}{`\V}{"1D685}%
\MathAlphabetChar{\mathtt}{`\W}{"1D686}%
\MathAlphabetChar{\mathtt}{`\X}{"1D687}%
\MathAlphabetChar{\mathtt}{`\Y}{"1D688}%
\MathAlphabetChar{\mathtt}{`\Z}{"1D689}%

\MathAlphabetChar{\mathtt}{`\a}{"1D68A}%
\MathAlphabetChar{\mathtt}{`\b}{"1D68B}%
\MathAlphabetChar{\mathtt}{`\c}{"1D68C}%
\MathAlphabetChar{\mathtt}{`\d}{"1D68D}%
\MathAlphabetChar{\mathtt}{`\e}{"1D68E}%
\MathAlphabetChar{\mathtt}{`\f}{"1D68F}%
\MathAlphabetChar{\mathtt}{`\g}{"1D690}%
\MathAlphabetChar{\mathtt}{`\h}{"1D691}%
\MathAlphabetChar{\mathtt}{`\i}{"1D692}%
\MathAlphabetChar{\mathtt}{`\j}{"1D693}%
\MathAlphabetChar{\mathtt}{`\k}{"1D694}%
\MathAlphabetChar{\mathtt}{`\l}{"1D695}%
\MathAlphabetChar{\mathtt}{`\m}{"1D696}%
\MathAlphabetChar{\mathtt}{`\n}{"1D697}%
\MathAlphabetChar{\mathtt}{`\o}{"1D698}%
\MathAlphabetChar{\mathtt}{`\p}{"1D699}%
\MathAlphabetChar{\mathtt}{`\q}{"1D69A}%
\MathAlphabetChar{\mathtt}{`\r}{"1D69B}%
\MathAlphabetChar{\mathtt}{`\s}{"1D69C}%
\MathAlphabetChar{\mathtt}{`\t}{"1D69D}%
```

```
\MathAlphabetChar{\mathtt}{`\u}{"1D69E}%
\MathAlphabetChar{\mathtt}{`\v}{"1D69F}%
\MathAlphabetChar{\mathtt}{`\w}{"1D6A0}%
\MathAlphabetChar{\mathtt}{`\x}{"1D6A1}%
\MathAlphabetChar{\mathtt}{`\y}{"1D6A2}%
\MathAlphabetChar{\mathtt}{`\z}{"1D6A3}%
```

5.4 Bold alphabets' character mappings

5.4.1 Bold: `\mathbf`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ
αβγδεζηθικλμνξοςρστυφχψω

```
\setmathfont{Cambria Math}
$\mathbf{0123456789}$ \\
$\mathbf{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbf{abcdefghijklmnopqrstuvwxyz}$ \\
$\mathbf{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \\
$\mathbf{αβγδεζηθικλμνξοπρστυφχψω}$ \\
```

Numbers:

```
\MathAlphabetChar{\mathbf}{`\0}{"1D7CE}%
\MathAlphabetChar{\mathbf}{`\1}{"1D7CF}%
\MathAlphabetChar{\mathbf}{`\2}{"1D7D0}%
\MathAlphabetChar{\mathbf}{`\3}{"1D7D1}%
\MathAlphabetChar{\mathbf}{`\4}{"1D7D2}%
\MathAlphabetChar{\mathbf}{`\5}{"1D7D3}%
\MathAlphabetChar{\mathbf}{`\6}{"1D7D4}%
\MathAlphabetChar{\mathbf}{`\7}{"1D7D5}%
\MathAlphabetChar{\mathbf}{`\8}{"1D7D6}%
\MathAlphabetChar{\mathbf}{`\9}{"1D7D7}%
```

Letters:

```
\MathAlphabetChar{\mathbf}{`\A}{"1D400}%
\MathAlphabetChar{\mathbf}{`\B}{"1D401}%
\MathAlphabetChar{\mathbf}{`\C}{"1D402}%
\MathAlphabetChar{\mathbf}{`\D}{"1D403}%
\MathAlphabetChar{\mathbf}{`\E}{"1D404}%
\MathAlphabetChar{\mathbf}{`\F}{"1D405}%
\MathAlphabetChar{\mathbf}{`\G}{"1D406}%
\MathAlphabetChar{\mathbf}{`\H}{"1D407}%
\MathAlphabetChar{\mathbf}{`\I}{"1D408}%
\MathAlphabetChar{\mathbf}{`\J}{"1D409}%
\MathAlphabetChar{\mathbf}{`\K}{"1D40A}%
\MathAlphabetChar{\mathbf}{`\L}{"1D40B}%
\MathAlphabetChar{\mathbf}{`\M}{"1D40C}%
\MathAlphabetChar{\mathbf}{`\N}{"1D40D}%
\MathAlphabetChar{\mathbf}{`\O}{"1D40E}%
```

```
\MathAlphabetChar{\mathbf}{`\P}{"1D40F}%
\MathAlphabetChar{\mathbf}{`\Q}{"1D410}%
\MathAlphabetChar{\mathbf}{`\R}{"1D411}%
\MathAlphabetChar{\mathbf}{`\S}{"1D412}%
\MathAlphabetChar{\mathbf}{`\T}{"1D413}%
\MathAlphabetChar{\mathbf}{`\U}{"1D414}%
\MathAlphabetChar{\mathbf}{`\V}{"1D415}%
\MathAlphabetChar{\mathbf}{`\W}{"1D416}%
\MathAlphabetChar{\mathbf}{`\X}{"1D417}%
\MathAlphabetChar{\mathbf}{`\Y}{"1D418}%
\MathAlphabetChar{\mathbf}{`\Z}{"1D419}%

\MathAlphabetChar{\mathbf}{`\a}{"1D41A}%
\MathAlphabetChar{\mathbf}{`\b}{"1D41B}%
\MathAlphabetChar{\mathbf}{`\c}{"1D41C}%
\MathAlphabetChar{\mathbf}{`\d}{"1D41D}%
\MathAlphabetChar{\mathbf}{`\e}{"1D41E}%
\MathAlphabetChar{\mathbf}{`\f}{"1D41F}%
\MathAlphabetChar{\mathbf}{`\g}{"1D420}%
\MathAlphabetChar{\mathbf}{`\h}{"1D421}%
\MathAlphabetChar{\mathbf}{`\i}{"1D422}%
\MathAlphabetChar{\mathbf}{`\j}{"1D423}%
\MathAlphabetChar{\mathbf}{`\k}{"1D424}%
\MathAlphabetChar{\mathbf}{`\l}{"1D425}%
\MathAlphabetChar{\mathbf}{`\m}{"1D426}%
\MathAlphabetChar{\mathbf}{`\n}{"1D427}%
\MathAlphabetChar{\mathbf}{`\o}{"1D428}%
\MathAlphabetChar{\mathbf}{`\p}{"1D429}%
\MathAlphabetChar{\mathbf}{`\q}{"1D42A}%
\MathAlphabetChar{\mathbf}{`\r}{"1D42B}%
\MathAlphabetChar{\mathbf}{`\s}{"1D42C}%
\MathAlphabetChar{\mathbf}{`\t}{"1D42D}%
\MathAlphabetChar{\mathbf}{`\u}{"1D42E}%
\MathAlphabetChar{\mathbf}{`\v}{"1D42F}%
\MathAlphabetChar{\mathbf}{`\w}{"1D430}%
\MathAlphabetChar{\mathbf}{`\x}{"1D431}%
\MathAlphabetChar{\mathbf}{`\y}{"1D432}%
\MathAlphabetChar{\mathbf}{`\z}{"1D433}%
```

Greek letters:

```
\MathAlphabetChar{\mathbf}{913}{"1D6A8}% ALPHA
\MathAlphabetChar{\mathbf}{914}{"1D6A9}% BETA
\MathAlphabetChar{\mathbf}{915}{"1D6AA}% GAMMA
\MathAlphabetChar{\mathbf}{916}{"1D6AB}% delta
\MathAlphabetChar{\mathbf}{917}{"1D6AC}% epsilon
\MathAlphabetChar{\mathbf}{918}{"1D6AD}% zeta
\MathAlphabetChar{\mathbf}{919}{"1D6AE}% eta
\MathAlphabetChar{\mathbf}{920}{"1D6AF}% theta
```

```
\MathAlphabetChar{\mathbf}{921}{"1D6B0}% iota
\MathAlphabetChar{\mathbf}{922}{"1D6B1}% kappa
\MathAlphabetChar{\mathbf}{923}{"1D6B2}% lambda
\MathAlphabetChar{\mathbf}{924}{"1D6B3}% mu
\MathAlphabetChar{\mathbf}{925}{"1D6B4}% nu
\MathAlphabetChar{\mathbf}{926}{"1D6B5}% xi
\MathAlphabetChar{\mathbf}{927}{"1D6B6}% omicron
\MathAlphabetChar{\mathbf}{928}{"1D6B7}% pi
\MathAlphabetChar{\mathbf}{929}{"1D6B8}% rho
%\MathAlphabetChar{\mathbf}{??}{"1D6B9}% theta symbol
\MathAlphabetChar{\mathbf}{931}{"1D6BA}% sigma
\MathAlphabetChar{\mathbf}{932}{"1D6BB}% tau
\MathAlphabetChar{\mathbf}{933}{"1D6BC}% upsilon
\MathAlphabetChar{\mathbf}{934}{"1D6BD}% phi
\MathAlphabetChar{\mathbf}{935}{"1D6BE}% chi
\MathAlphabetChar{\mathbf}{936}{"1D6BF}% psi
\MathAlphabetChar{\mathbf}{937}{"1D6C0}% omega
\MathAlphabetChar{\mathbf}{"2207}{"1D6C1}% NABLA
```

Greek lowercase:

```
\MathAlphabetChar{\mathbf}{945}{"1D6C2}%
\MathAlphabetChar{\mathbf}{946}{"1D6C3}%
\MathAlphabetChar{\mathbf}{947}{"1D6C4}%
\MathAlphabetChar{\mathbf}{948}{"1D6C5}%
\MathAlphabetChar{\mathbf}{949}{"1D6C6}%
\MathAlphabetChar{\mathbf}{950}{"1D6C7}%
\MathAlphabetChar{\mathbf}{951}{"1D6C8}%
\MathAlphabetChar{\mathbf}{952}{"1D6C9}%
\MathAlphabetChar{\mathbf}{953}{"1D6CA}%
\MathAlphabetChar{\mathbf}{954}{"1D6CB}%
\MathAlphabetChar{\mathbf}{955}{"1D6CC}%
\MathAlphabetChar{\mathbf}{956}{"1D6CD}%
\MathAlphabetChar{\mathbf}{957}{"1D6CE}%
\MathAlphabetChar{\mathbf}{958}{"1D6CF}%
\MathAlphabetChar{\mathbf}{959}{"1D6D0}%
\MathAlphabetChar{\mathbf}{960}{"1D6D1}%
\MathAlphabetChar{\mathbf}{961}{"1D6D2}%
\MathAlphabetChar{\mathbf}{960}{"1D6D3}% VAR SIGMA
\MathAlphabetChar{\mathbf}{963}{"1D6D4}%
\MathAlphabetChar{\mathbf}{964}{"1D6D5}%
\MathAlphabetChar{\mathbf}{965}{"1D6D6}%
\MathAlphabetChar{\mathbf}{966}{"1D6D7}%
\MathAlphabetChar{\mathbf}{967}{"1D6D8}%
\MathAlphabetChar{\mathbf}{968}{"1D6D9}%
\MathAlphabetChar{\mathbf}{969}{"1D6DA}%
\MathAlphabetChar{\mathbf}{"2202}{"1D6DB}% PARTIAL
%\MathAlphabetChar{\mathbf}{??}{"1D6DC}% VAR EPSILON
```

```
%\MathAlphabetChar{\mathbf}{??}{"1D6DD}% VAR THETA
%\MathAlphabetChar{\mathbf}{??}{"1D6DE}% VAR KAPPA
%\MathAlphabetChar{\mathbf}{??}{"1D6DF}% VAR PHI
%\MathAlphabetChar{\mathbf}{??}{"1D6E0}% VAR RHO
%\MathAlphabetChar{\mathbf}{??}{"1D6E1}% VAR PI
```

TODO: nabla and others

5.4.2 Bold Italic: `\mathbfit`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ
αβγδεζηθικλμνξοςρστυφχψω

```
\setmathfont{Cambria Math}
$\mathbfit{0123456789}$ \\
$\mathbfit{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbfit{abcdefghijklmnopqrstuvwxyz}$ \\
$\mathbfit{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \\
$\mathbfit{αβγδεζηθικλμνξοπρστυφχψω}$ \\
```

Bold numbers: (always upright)

```
\MathAlphabetChar{\mathbfit}{`\0}{"1D7CE}%
\MathAlphabetChar{\mathbfit}{`\1}{"1D7CF}%
\MathAlphabetChar{\mathbfit}{`\2}{"1D7D0}%
\MathAlphabetChar{\mathbfit}{`\3}{"1D7D1}%
\MathAlphabetChar{\mathbfit}{`\4}{"1D7D2}%
\MathAlphabetChar{\mathbfit}{`\5}{"1D7D3}%
\MathAlphabetChar{\mathbfit}{`\6}{"1D7D4}%
\MathAlphabetChar{\mathbfit}{`\7}{"1D7D5}%
\MathAlphabetChar{\mathbfit}{`\8}{"1D7D6}%
\MathAlphabetChar{\mathbfit}{`\9}{"1D7D7}%
```

Letters:

```
\MathAlphabetChar{\mathbfit}{`\A}{"1D468}%
\MathAlphabetChar{\mathbfit}{`\B}{"1D469}%
\MathAlphabetChar{\mathbfit}{`\C}{"1D46A}%
\MathAlphabetChar{\mathbfit}{`\D}{"1D46B}%
\MathAlphabetChar{\mathbfit}{`\E}{"1D46C}%
\MathAlphabetChar{\mathbfit}{`\F}{"1D46D}%
\MathAlphabetChar{\mathbfit}{`\G}{"1D46E}%
\MathAlphabetChar{\mathbfit}{`\H}{"1D46F}%
\MathAlphabetChar{\mathbfit}{`\I}{"1D470}%
\MathAlphabetChar{\mathbfit}{`\J}{"1D471}%
\MathAlphabetChar{\mathbfit}{`\K}{"1D472}%
\MathAlphabetChar{\mathbfit}{`\L}{"1D473}%
\MathAlphabetChar{\mathbfit}{`\M}{"1D474}%
\MathAlphabetChar{\mathbfit}{`\N}{"1D475}%
\MathAlphabetChar{\mathbfit}{`\O}{"1D476}%
\MathAlphabetChar{\mathbfit}{`\P}{"1D477}%
```

```
\MathAlphabetChar{\mathbfit}{`\Q}{"1D478}%
\MathAlphabetChar{\mathbfit}{`\R}{"1D479}%
\MathAlphabetChar{\mathbfit}{`\S}{"1D47A}%
\MathAlphabetChar{\mathbfit}{`\T}{"1D47B}%
\MathAlphabetChar{\mathbfit}{`\U}{"1D47C}%
\MathAlphabetChar{\mathbfit}{`\V}{"1D47D}%
\MathAlphabetChar{\mathbfit}{`\W}{"1D47E}%
\MathAlphabetChar{\mathbfit}{`\X}{"1D47F}%
\MathAlphabetChar{\mathbfit}{`\Y}{"1D480}%
\MathAlphabetChar{\mathbfit}{`\Z}{"1D481}%
```

```
\MathAlphabetChar{\mathbfit}{`\a}{"1D482}%
\MathAlphabetChar{\mathbfit}{`\b}{"1D483}%
\MathAlphabetChar{\mathbfit}{`\c}{"1D484}%
\MathAlphabetChar{\mathbfit}{`\d}{"1D485}%
\MathAlphabetChar{\mathbfit}{`\e}{"1D486}%
\MathAlphabetChar{\mathbfit}{`\f}{"1D487}%
\MathAlphabetChar{\mathbfit}{`\g}{"1D488}%
\MathAlphabetChar{\mathbfit}{`\h}{"1D489}%
\MathAlphabetChar{\mathbfit}{`\i}{"1D48A}%
\MathAlphabetChar{\mathbfit}{`\j}{"1D48B}%
\MathAlphabetChar{\mathbfit}{`\k}{"1D48C}%
\MathAlphabetChar{\mathbfit}{`\l}{"1D48D}%
\MathAlphabetChar{\mathbfit}{`\m}{"1D48E}%
\MathAlphabetChar{\mathbfit}{`\n}{"1D48F}%
\MathAlphabetChar{\mathbfit}{`\o}{"1D490}%
\MathAlphabetChar{\mathbfit}{`\p}{"1D491}%
\MathAlphabetChar{\mathbfit}{`\q}{"1D492}%
\MathAlphabetChar{\mathbfit}{`\r}{"1D493}%
\MathAlphabetChar{\mathbfit}{`\s}{"1D494}%
\MathAlphabetChar{\mathbfit}{`\t}{"1D495}%
\MathAlphabetChar{\mathbfit}{`\u}{"1D496}%
\MathAlphabetChar{\mathbfit}{`\v}{"1D497}%
\MathAlphabetChar{\mathbfit}{`\w}{"1D498}%
\MathAlphabetChar{\mathbfit}{`\x}{"1D499}%
\MathAlphabetChar{\mathbfit}{`\y}{"1D49A}%
\MathAlphabetChar{\mathbfit}{`\z}{"1D49B}%
```

Greek letters:

```
\MathAlphabetChar{\mathbfit}{913}{"1D71C}% Alpha
\MathAlphabetChar{\mathbfit}{914}{"1D71D}% Beta
\MathAlphabetChar{\mathbfit}{915}{"1D71E}% Gamma
\MathAlphabetChar{\mathbfit}{916}{"1D71F}% Delta
\MathAlphabetChar{\mathbfit}{917}{"1D720}% Epsilon
\MathAlphabetChar{\mathbfit}{918}{"1D721}% Zeta
\MathAlphabetChar{\mathbfit}{919}{"1D722}% Eta
\MathAlphabetChar{\mathbfit}{920}{"1D723}% theta
\MathAlphabetChar{\mathbfit}{921}{"1D724}% iota
```

```
\MathAlphabetChar{\mathbfit}{922}{"1D725}% kappa
\MathAlphabetChar{\mathbfit}{923}{"1D726}% lambda
\MathAlphabetChar{\mathbfit}{924}{"1D727}% mu
\MathAlphabetChar{\mathbfit}{925}{"1D728}% nu
\MathAlphabetChar{\mathbfit}{926}{"1D729}% xi
\MathAlphabetChar{\mathbfit}{927}{"1D72A}% omicron
\MathAlphabetChar{\mathbfit}{928}{"1D72B}% pi
\MathAlphabetChar{\mathbfit}{929}{"1D72C}% rho
%\MathAlphabetChar{\mathbfit}{??}{"1D72D}% VAR theta
\MathAlphabetChar{\mathbfit}{931}{"1D72E}% sigma
\MathAlphabetChar{\mathbfit}{932}{"1D72F}% tau
\MathAlphabetChar{\mathbfit}{933}{"1D730}% upsilon
\MathAlphabetChar{\mathbfit}{934}{"1D731}% phi
\MathAlphabetChar{\mathbfit}{935}{"1D732}% chi
\MathAlphabetChar{\mathbfit}{936}{"1D733}% psi
\MathAlphabetChar{\mathbfit}{937}{"1D734}% omega
\MathAlphabetChar{\mathbfit}{"2207}{"1D735}% NABLA
```

Greek lowercase:

```
\MathAlphabetChar{\mathbfit}{945}{"1D736}%
\MathAlphabetChar{\mathbfit}{946}{"1D737}%
\MathAlphabetChar{\mathbfit}{947}{"1D738}%
\MathAlphabetChar{\mathbfit}{948}{"1D739}%
\MathAlphabetChar{\mathbfit}{949}{"1D73A}%
\MathAlphabetChar{\mathbfit}{950}{"1D73B}%
\MathAlphabetChar{\mathbfit}{951}{"1D73C}%
\MathAlphabetChar{\mathbfit}{952}{"1D73D}%
\MathAlphabetChar{\mathbfit}{953}{"1D73E}%
\MathAlphabetChar{\mathbfit}{954}{"1D73F}%
\MathAlphabetChar{\mathbfit}{955}{"1D740}%
\MathAlphabetChar{\mathbfit}{956}{"1D741}%
\MathAlphabetChar{\mathbfit}{957}{"1D742}%
\MathAlphabetChar{\mathbfit}{958}{"1D743}%
\MathAlphabetChar{\mathbfit}{959}{"1D744}%
\MathAlphabetChar{\mathbfit}{960}{"1D745}%
\MathAlphabetChar{\mathbfit}{961}{"1D746}%
\MathAlphabetChar{\mathbfit}{960}{"1D747}% VAR SIGMA
\MathAlphabetChar{\mathbfit}{963}{"1D748}%
\MathAlphabetChar{\mathbfit}{964}{"1D749}%
\MathAlphabetChar{\mathbfit}{965}{"1D74A}%
\MathAlphabetChar{\mathbfit}{966}{"1D74B}%
\MathAlphabetChar{\mathbfit}{967}{"1D74C}%
\MathAlphabetChar{\mathbfit}{968}{"1D74D}%
\MathAlphabetChar{\mathbfit}{969}{"1D74E}%
\MathAlphabetChar{\mathbfit}{"2202}{"1D74F}% PARTIAL
%\MathAlphabetChar{\mathbfit}{??}{"1D750}% VAR EPSILON
%\MathAlphabetChar{\mathbfit}{??}{"1D751}% VAR THETA
```

```
%\MathAlphabetChar{\mathbfit}{??}{"1D752}% VAR KAPPA
%\MathAlphabetChar{\mathbfit}{??}{"1D753}% VAR PHI
%\MathAlphabetChar{\mathbfit}{??}{"1D754}% VAR RHO
%\MathAlphabetChar{\mathbfit}{??}{"1D755}% VAR PI
```

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


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

Bold numbers: (always upright)

```
\MathAlphabetChar{\mathbffrak}{`\0}{"1D7CE}%
\MathAlphabetChar{\mathbffrak}{`\1}{"1D7CF}%
\MathAlphabetChar{\mathbffrak}{`\2}{"1D7D0}%
\MathAlphabetChar{\mathbffrak}{`\3}{"1D7D1}%
\MathAlphabetChar{\mathbffrak}{`\4}{"1D7D2}%
\MathAlphabetChar{\mathbffrak}{`\5}{"1D7D3}%
\MathAlphabetChar{\mathbffrak}{`\6}{"1D7D4}%
\MathAlphabetChar{\mathbffrak}{`\7}{"1D7D5}%
\MathAlphabetChar{\mathbffrak}{`\8}{"1D7D6}%
\MathAlphabetChar{\mathbffrak}{`\9}{"1D7D7}%
```

Letters:

```
\MathAlphabetChar{\mathbffrak}{`\A}{"1D56C}%
\MathAlphabetChar{\mathbffrak}{`\B}{"1D56D}%
\MathAlphabetChar{\mathbffrak}{`\C}{"1D56E}%
\MathAlphabetChar{\mathbffrak}{`\D}{"1D56F}%
\MathAlphabetChar{\mathbffrak}{`\E}{"1D570}%
\MathAlphabetChar{\mathbffrak}{`\F}{"1D571}%
\MathAlphabetChar{\mathbffrak}{`\G}{"1D572}%
\MathAlphabetChar{\mathbffrak}{`\H}{"1D573}%
\MathAlphabetChar{\mathbffrak}{`\I}{"1D574}%
\MathAlphabetChar{\mathbffrak}{`\J}{"1D575}%
\MathAlphabetChar{\mathbffrak}{`\K}{"1D576}%
\MathAlphabetChar{\mathbffrak}{`\L}{"1D577}%
\MathAlphabetChar{\mathbffrak}{`\M}{"1D578}%
\MathAlphabetChar{\mathbffrak}{`\N}{"1D579}%
\MathAlphabetChar{\mathbffrak}{`\O}{"1D57A}%
\MathAlphabetChar{\mathbffrak}{`\P}{"1D57B}%
\MathAlphabetChar{\mathbffrak}{`\Q}{"1D57C}%
\MathAlphabetChar{\mathbffrak}{`\R}{"1D57D}%
\MathAlphabetChar{\mathbffrak}{`\S}{"1D57E}%
\MathAlphabetChar{\mathbffrak}{`\T}{"1D57F}%
\MathAlphabetChar{\mathbffrak}{`\U}{"1D580}%
\MathAlphabetChar{\mathbffrak}{`\V}{"1D581}%
```

```
\MathAlphabetChar{\mathbffrak}{`\W}{"1D582}%
\MathAlphabetChar{\mathbffrak}{`\X}{"1D583}%
\MathAlphabetChar{\mathbffrak}{`\Y}{"1D584}%
\MathAlphabetChar{\mathbffrak}{`\Z}{"1D585}%

\MathAlphabetChar{\mathbffrak}{`\a}{"1D586}%
\MathAlphabetChar{\mathbffrak}{`\b}{"1D587}%
\MathAlphabetChar{\mathbffrak}{`\c}{"1D588}%
\MathAlphabetChar{\mathbffrak}{`\d}{"1D589}%
\MathAlphabetChar{\mathbffrak}{`\e}{"1D58A}%
\MathAlphabetChar{\mathbffrak}{`\f}{"1D58B}%
\MathAlphabetChar{\mathbffrak}{`\g}{"1D58C}%
\MathAlphabetChar{\mathbffrak}{`\h}{"1D58D}%
\MathAlphabetChar{\mathbffrak}{`\i}{"1D58E}%
\MathAlphabetChar{\mathbffrak}{`\j}{"1D58F}%
\MathAlphabetChar{\mathbffrak}{`\k}{"1D590}%
\MathAlphabetChar{\mathbffrak}{`\l}{"1D591}%
\MathAlphabetChar{\mathbffrak}{`\m}{"1D592}%
\MathAlphabetChar{\mathbffrak}{`\n}{"1D593}%
\MathAlphabetChar{\mathbffrak}{`\o}{"1D594}%
\MathAlphabetChar{\mathbffrak}{`\p}{"1D595}%
\MathAlphabetChar{\mathbffrak}{`\q}{"1D596}%
\MathAlphabetChar{\mathbffrak}{`\r}{"1D597}%
\MathAlphabetChar{\mathbffrak}{`\s}{"1D598}%
\MathAlphabetChar{\mathbffrak}{`\t}{"1D599}%
\MathAlphabetChar{\mathbffrak}{`\u}{"1D59A}%
\MathAlphabetChar{\mathbffrak}{`\v}{"1D59B}%
\MathAlphabetChar{\mathbffrak}{`\w}{"1D59C}%
\MathAlphabetChar{\mathbffrak}{`\x}{"1D59D}%
\MathAlphabetChar{\mathbffrak}{`\y}{"1D59E}%
\MathAlphabetChar{\mathbffrak}{`\z}{"1D59F}%
```

5.4.4 Bold script or calligraphic: `\mathbfscr`

$\mathbfscr{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbfscr{abcdefghijklmnopqrstuvwxyz}$ \\

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

Bold numbers: (always upright)

```
\MathAlphabetChar{\mathbfscr}{`\0}{"1D7CE}%
\MathAlphabetChar{\mathbfscr}{`\1}{"1D7CF}%
\MathAlphabetChar{\mathbfscr}{`\2}{"1D7D0}%
\MathAlphabetChar{\mathbfscr}{`\3}{"1D7D1}%
\MathAlphabetChar{\mathbfscr}{`\4}{"1D7D2}%
\MathAlphabetChar{\mathbfscr}{`\5}{"1D7D3}%
\MathAlphabetChar{\mathbfscr}{`\6}{"1D7D4}%
```

```
\MathAlphabetChar{\mathbfscr}{`\7}{"1D7D5}%
\MathAlphabetChar{\mathbfscr}{`\8}{"1D7D6}%
\MathAlphabetChar{\mathbfscr}{`\9}{"1D7D7}%
```

Letters:

```
\MathAlphabetChar{\mathbfscr}{`\A}{"1D4D0}%
\MathAlphabetChar{\mathbfscr}{`\B}{"1D4D1}%
\MathAlphabetChar{\mathbfscr}{`\C}{"1D4D2}%
\MathAlphabetChar{\mathbfscr}{`\D}{"1D4D3}%
\MathAlphabetChar{\mathbfscr}{`\E}{"1D4D4}%
\MathAlphabetChar{\mathbfscr}{`\F}{"1D4D5}%
\MathAlphabetChar{\mathbfscr}{`\G}{"1D4D6}%
\MathAlphabetChar{\mathbfscr}{`\H}{"1D4D7}%
\MathAlphabetChar{\mathbfscr}{`\I}{"1D4D8}%
\MathAlphabetChar{\mathbfscr}{`\J}{"1D4D9}%
\MathAlphabetChar{\mathbfscr}{`\K}{"1D4DA}%
\MathAlphabetChar{\mathbfscr}{`\L}{"1D4DB}%
\MathAlphabetChar{\mathbfscr}{`\M}{"1D4DC}%
\MathAlphabetChar{\mathbfscr}{`\N}{"1D4DD}%
\MathAlphabetChar{\mathbfscr}{`\O}{"1D4DE}%
\MathAlphabetChar{\mathbfscr}{`\P}{"1D4DF}%
\MathAlphabetChar{\mathbfscr}{`\Q}{"1D4E0}%
\MathAlphabetChar{\mathbfscr}{`\R}{"1D4E1}%
\MathAlphabetChar{\mathbfscr}{`\S}{"1D4E2}%
\MathAlphabetChar{\mathbfscr}{`\T}{"1D4E3}%
\MathAlphabetChar{\mathbfscr}{`\U}{"1D4E4}%
\MathAlphabetChar{\mathbfscr}{`\V}{"1D4E5}%
\MathAlphabetChar{\mathbfscr}{`\W}{"1D4E6}%
\MathAlphabetChar{\mathbfscr}{`\X}{"1D4E7}%
\MathAlphabetChar{\mathbfscr}{`\Y}{"1D4E8}%
\MathAlphabetChar{\mathbfscr}{`\Z}{"1D4E9}%
```

```
\MathAlphabetChar{\mathbfscr}{`\a}{"1D4EA}%
\MathAlphabetChar{\mathbfscr}{`\b}{"1D4EB}%
\MathAlphabetChar{\mathbfscr}{`\c}{"1D4EC}%
\MathAlphabetChar{\mathbfscr}{`\d}{"1D4ED}%
\MathAlphabetChar{\mathbfscr}{`\e}{"1D4EE}%
\MathAlphabetChar{\mathbfscr}{`\f}{"1D4EF}%
\MathAlphabetChar{\mathbfscr}{`\g}{"1D4F0}%
\MathAlphabetChar{\mathbfscr}{`\h}{"1D4F1}%
\MathAlphabetChar{\mathbfscr}{`\i}{"1D4F2}%
\MathAlphabetChar{\mathbfscr}{`\j}{"1D4F3}%
\MathAlphabetChar{\mathbfscr}{`\k}{"1D4F4}%
\MathAlphabetChar{\mathbfscr}{`\l}{"1D4F5}%
\MathAlphabetChar{\mathbfscr}{`\m}{"1D4F6}%
\MathAlphabetChar{\mathbfscr}{`\n}{"1D4F7}%
\MathAlphabetChar{\mathbfscr}{`\o}{"1D4F8}%
\MathAlphabetChar{\mathbfscr}{`\p}{"1D4F9}%
```

```
\MathAlphabetChar{\mathbfscr}{`\q}{"1D4FA}%
\MathAlphabetChar{\mathbfscr}{`\r}{"1D4FB}%
\MathAlphabetChar{\mathbfscr}{`\s}{"1D4FC}%
\MathAlphabetChar{\mathbfscr}{`\t}{"1D4FD}%
\MathAlphabetChar{\mathbfscr}{`\u}{"1D4FE}%
\MathAlphabetChar{\mathbfscr}{`\v}{"1D4FF}%
\MathAlphabetChar{\mathbfscr}{`\w}{"1D500}%
\MathAlphabetChar{\mathbfscr}{`\x}{"1D501}%
\MathAlphabetChar{\mathbfscr}{`\y}{"1D502}%
\MathAlphabetChar{\mathbfscr}{`\z}{"1D503}%
```

5.4.5 Bold sans serif: `\mathbfsf`

0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
𝟬𝟭𝟮𝟯𝟰𝟱𝟲𝟳𝟴𝟵𝗔𝗕𝗖𝗗𝗘𝗙𝗚𝗛𝗜𝗝𝗞𝗟𝗠𝗡𝗢𝗣𝗤𝗥𝗦𝗧𝗨𝗩𝗪𝗫𝗬𝗭𝗮𝗯𝗰𝗱𝗲𝗳𝗴𝗵𝗶𝗷𝗸𝗹𝗺𝗻𝗼𝗽𝗾𝗿𝘀𝘁𝘂𝘃𝘄𝘅𝘆𝘇
𝝖𝝗𝝘𝝙𝝚𝝛𝝜𝝝𝝞𝝟𝝠𝝨𝝩𝝪𝝫𝝬𝝭𝝮𝝯𝝰𝝱𝝲𝝳𝝴𝝵𝝶𝝷𝝸𝝹𝝺𝝻𝝼𝝽𝝾𝝿𝞀𝞁𝞂𝞃𝞄𝞅𝞆𝞇𝞈

```
\setmathfont{Cambria Math}
$\mathbfsf{0123456789}$ \\
$\mathbfsf{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbfsf{abcdefghijklmnopqrstuvwxyz}$ \\
$\mathbfsf{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \\
$\mathbfsf{αβγδεζηθικλμνξοπρστυφχψω}$ \\
```

Numbers: (always upright)

```
\MathAlphabetChar{\mathbfsf}{`\0}{"1D7EC}%
\MathAlphabetChar{\mathbfsf}{`\1}{"1D7ED}%
\MathAlphabetChar{\mathbfsf}{`\2}{"1D7EE}%
\MathAlphabetChar{\mathbfsf}{`\3}{"1D7EF}%
\MathAlphabetChar{\mathbfsf}{`\4}{"1D7F0}%
\MathAlphabetChar{\mathbfsf}{`\5}{"1D7F1}%
\MathAlphabetChar{\mathbfsf}{`\6}{"1D7F2}%
\MathAlphabetChar{\mathbfsf}{`\7}{"1D7F3}%
\MathAlphabetChar{\mathbfsf}{`\8}{"1D7F4}%
\MathAlphabetChar{\mathbfsf}{`\9}{"1D7F5}%
```

Letters:

```
\MathAlphabetChar{\mathbfsf}{`\A}{"1D5D4}%
\MathAlphabetChar{\mathbfsf}{`\B}{"1D5D5}%
\MathAlphabetChar{\mathbfsf}{`\C}{"1D5D6}%
\MathAlphabetChar{\mathbfsf}{`\D}{"1D5D7}%
\MathAlphabetChar{\mathbfsf}{`\E}{"1D5D8}%
\MathAlphabetChar{\mathbfsf}{`\F}{"1D5D9}%
\MathAlphabetChar{\mathbfsf}{`\G}{"1D5DA}%
\MathAlphabetChar{\mathbfsf}{`\H}{"1D5DB}%
\MathAlphabetChar{\mathbfsf}{`\I}{"1D5DC}%
\MathAlphabetChar{\mathbfsf}{`\J}{"1D5DD}%
\MathAlphabetChar{\mathbfsf}{`\K}{"1D5DE}%
\MathAlphabetChar{\mathbfsf}{`\L}{"1D5DF}%
\MathAlphabetChar{\mathbfsf}{`\M}{"1D5E0}%
```

```
\MathAlphabetChar{\mathbfsf}{`\N}{"1D5E1}%
\MathAlphabetChar{\mathbfsf}{`\O}{"1D5E2}%
\MathAlphabetChar{\mathbfsf}{`\P}{"1D5E3}%
\MathAlphabetChar{\mathbfsf}{`\Q}{"1D5E4}%
\MathAlphabetChar{\mathbfsf}{`\R}{"1D5E5}%
\MathAlphabetChar{\mathbfsf}{`\S}{"1D5E6}%
\MathAlphabetChar{\mathbfsf}{`\T}{"1D5E7}%
\MathAlphabetChar{\mathbfsf}{`\U}{"1D5E8}%
\MathAlphabetChar{\mathbfsf}{`\V}{"1D5E9}%
\MathAlphabetChar{\mathbfsf}{`\W}{"1D5EA}%
\MathAlphabetChar{\mathbfsf}{`\X}{"1D5EB}%
\MathAlphabetChar{\mathbfsf}{`\Y}{"1D5EC}%
\MathAlphabetChar{\mathbfsf}{`\Z}{"1D5ED}%

\MathAlphabetChar{\mathbfsf}{`\a}{"1D5EE}%
\MathAlphabetChar{\mathbfsf}{`\b}{"1D5EF}%
\MathAlphabetChar{\mathbfsf}{`\c}{"1D5F0}%
\MathAlphabetChar{\mathbfsf}{`\d}{"1D5F1}%
\MathAlphabetChar{\mathbfsf}{`\e}{"1D5F2}%
\MathAlphabetChar{\mathbfsf}{`\f}{"1D5F3}%
\MathAlphabetChar{\mathbfsf}{`\g}{"1D5F4}%
\MathAlphabetChar{\mathbfsf}{`\h}{"1D5F5}%
\MathAlphabetChar{\mathbfsf}{`\i}{"1D5F6}%
\MathAlphabetChar{\mathbfsf}{`\j}{"1D5F7}%
\MathAlphabetChar{\mathbfsf}{`\k}{"1D5F8}%
\MathAlphabetChar{\mathbfsf}{`\l}{"1D5F9}%
\MathAlphabetChar{\mathbfsf}{`\m}{"1D5FA}%
\MathAlphabetChar{\mathbfsf}{`\n}{"1D5FB}%
\MathAlphabetChar{\mathbfsf}{`\o}{"1D5FC}%
\MathAlphabetChar{\mathbfsf}{`\p}{"1D5FD}%
\MathAlphabetChar{\mathbfsf}{`\q}{"1D5FE}%
\MathAlphabetChar{\mathbfsf}{`\r}{"1D5FF}%
\MathAlphabetChar{\mathbfsf}{`\s}{"1D600}%
\MathAlphabetChar{\mathbfsf}{`\t}{"1D601}%
\MathAlphabetChar{\mathbfsf}{`\u}{"1D602}%
\MathAlphabetChar{\mathbfsf}{`\v}{"1D603}%
\MathAlphabetChar{\mathbfsf}{`\w}{"1D604}%
\MathAlphabetChar{\mathbfsf}{`\x}{"1D605}%
\MathAlphabetChar{\mathbfsf}{`\y}{"1D606}%
\MathAlphabetChar{\mathbfsf}{`\z}{"1D607}%
```

Greek letters:

```
\MathAlphabetChar{\mathbfsf}{913}{"1D756}% Alpha
\MathAlphabetChar{\mathbfsf}{914}{"1D757}% Beta
\MathAlphabetChar{\mathbfsf}{915}{"1D758}% Gamma
\MathAlphabetChar{\mathbfsf}{916}{"1D759}% Delta
\MathAlphabetChar{\mathbfsf}{917}{"1D75A}% Epsilon
\MathAlphabetChar{\mathbfsf}{918}{"1D75B}% Zeta
```

```
\MathAlphabetChar{\mathbfsf}{919}{"1D75C}% Eta
\MathAlphabetChar{\mathbfsf}{920}{"1D75D}% theta
\MathAlphabetChar{\mathbfsf}{921}{"1D75E}% iota
\MathAlphabetChar{\mathbfsf}{922}{"1D75F}% kappa
\MathAlphabetChar{\mathbfsf}{923}{"1D760}% lambda
\MathAlphabetChar{\mathbfsf}{924}{"1D761}% mu
\MathAlphabetChar{\mathbfsf}{925}{"1D762}% nu
\MathAlphabetChar{\mathbfsf}{926}{"1D763}% xi
\MathAlphabetChar{\mathbfsf}{927}{"1D764}% omicron
\MathAlphabetChar{\mathbfsf}{928}{"1D765}% pi
\MathAlphabetChar{\mathbfsf}{929}{"1D766}% rho
%\MathAlphabetChar{\mathbfsf}{??}{"1D767}% VAR theta
\MathAlphabetChar{\mathbfsf}{931}{"1D768}% sigma
\MathAlphabetChar{\mathbfsf}{932}{"1D769}% tau
\MathAlphabetChar{\mathbfsf}{933}{"1D76A}% upsilon
\MathAlphabetChar{\mathbfsf}{934}{"1D76B}% phi
\MathAlphabetChar{\mathbfsf}{935}{"1D76C}% chi
\MathAlphabetChar{\mathbfsf}{936}{"1D76D}% psi
\MathAlphabetChar{\mathbfsf}{937}{"1D76E}% omega
\MathAlphabetChar{\mathbfsf}{"2207}{"1D76F}% NABLA
```

Greek lowercase:

```
\MathAlphabetChar{\mathbfsf}{945}{"1D770}%
\MathAlphabetChar{\mathbfsf}{946}{"1D771}%
\MathAlphabetChar{\mathbfsf}{947}{"1D772}%
\MathAlphabetChar{\mathbfsf}{948}{"1D773}%
\MathAlphabetChar{\mathbfsf}{949}{"1D774}%
\MathAlphabetChar{\mathbfsf}{950}{"1D775}%
\MathAlphabetChar{\mathbfsf}{951}{"1D776}%
\MathAlphabetChar{\mathbfsf}{952}{"1D777}%
\MathAlphabetChar{\mathbfsf}{953}{"1D778}%
\MathAlphabetChar{\mathbfsf}{954}{"1D779}%
\MathAlphabetChar{\mathbfsf}{955}{"1D77A}%
\MathAlphabetChar{\mathbfsf}{956}{"1D77B}%
\MathAlphabetChar{\mathbfsf}{957}{"1D77C}%
\MathAlphabetChar{\mathbfsf}{958}{"1D77D}%
\MathAlphabetChar{\mathbfsf}{959}{"1D77E}%
\MathAlphabetChar{\mathbfsf}{960}{"1D77F}%
\MathAlphabetChar{\mathbfsf}{961}{"1D780}%
\MathAlphabetChar{\mathbfsf}{960}{"1D781}% VAR SIGMA
\MathAlphabetChar{\mathbfsf}{963}{"1D782}%
\MathAlphabetChar{\mathbfsf}{964}{"1D783}%
\MathAlphabetChar{\mathbfsf}{965}{"1D784}%
\MathAlphabetChar{\mathbfsf}{966}{"1D785}%
\MathAlphabetChar{\mathbfsf}{967}{"1D786}%
\MathAlphabetChar{\mathbfsf}{968}{"1D787}%
\MathAlphabetChar{\mathbfsf}{969}{"1D788}%
```

```
\MathAlphabetChar{\mathbfsf}{"2202}{"1D789}% PARTIAL
%\MathAlphabetChar{\mathbfsf}{??}{"1D78A}% VAR EPSILON
%\MathAlphabetChar{\mathbfsf}{??}{"1D78B}% VAR THETA
%\MathAlphabetChar{\mathbfsf}{??}{"1D78C}% VAR KAPPA
%\MathAlphabetChar{\mathbfsf}{??}{"1D78D}% VAR PHI
%\MathAlphabetChar{\mathbfsf}{??}{"1D78E}% VAR RHO
%\MathAlphabetChar{\mathbfsf}{??}{"1D78F}% VAR PI
```

5.4.6 Bold italic sans serif: `\mathbfsfit`

𝟬𝟭𝟮𝟯𝟰𝟱𝟲𝟳𝟴𝟵
𝘼𝘽𝘾𝘿𝙀𝙁𝙂𝙃𝙄𝙅𝙆𝙇𝙈𝙉𝙊𝙋𝙌𝙍𝙎𝙏𝙐𝙑𝙒𝙓𝙔𝙕
𝙖𝙗𝙘𝙙𝙚𝙛𝙜𝙝𝙞𝙟𝙠𝙡𝙢𝙣𝙤𝙥𝙦𝙧𝙨𝙩𝙪𝙫𝙬𝙭𝙮𝙯
𝜠𝜡𝜢𝜣𝜤𝜥𝜦𝜧𝜨𝜩𝜪𝜫𝜬𝜭𝜮𝜯𝜰𝜱𝜲𝜳𝜴𝜵𝜶𝜷𝜸𝜹𝜺𝜻𝜼𝜽𝜾𝜿𝝀𝝁𝝂𝝃𝝄𝝅𝝆𝝇𝝈𝝉𝝊𝝋𝝌𝝍𝝎
𝝏𝝐𝝑𝝒𝝓𝝔𝝕

```
\setmathfont{Cambria Math}
$\mathbfsfit{0123456789}$ \\
$\mathbfsfit{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$ \\
$\mathbfsfit{abcdefghijklmnopqrstuvwxyz}$ \\
$\mathbfsfit{ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$ \\
$\mathbfsfit{αβγδεζηθικλμνξοπρστυφχψω}$ \\
```

Numbers (always upright):

```
\MathAlphabetChar{\mathbfsfit}{`\0}{"1D7EC}%
\MathAlphabetChar{\mathbfsfit}{`\1}{"1D7ED}%
\MathAlphabetChar{\mathbfsfit}{`\2}{"1D7EE}%
\MathAlphabetChar{\mathbfsfit}{`\3}{"1D7EF}%
\MathAlphabetChar{\mathbfsfit}{`\4}{"1D7F0}%
\MathAlphabetChar{\mathbfsfit}{`\5}{"1D7F1}%
\MathAlphabetChar{\mathbfsfit}{`\6}{"1D7F2}%
\MathAlphabetChar{\mathbfsfit}{`\7}{"1D7F3}%
\MathAlphabetChar{\mathbfsfit}{`\8}{"1D7F4}%
\MathAlphabetChar{\mathbfsfit}{`\9}{"1D7F5}%
```

Roman uppercase:

```
\MathAlphabetChar{\mathbfsfit}{`\A}{"1D63C}%
\MathAlphabetChar{\mathbfsfit}{`\B}{"1D63D}%
\MathAlphabetChar{\mathbfsfit}{`\C}{"1D63E}%
\MathAlphabetChar{\mathbfsfit}{`\D}{"1D63F}%
\MathAlphabetChar{\mathbfsfit}{`\E}{"1D640}%
\MathAlphabetChar{\mathbfsfit}{`\F}{"1D641}%
\MathAlphabetChar{\mathbfsfit}{`\G}{"1D642}%
\MathAlphabetChar{\mathbfsfit}{`\H}{"1D643}%
\MathAlphabetChar{\mathbfsfit}{`\I}{"1D644}%
\MathAlphabetChar{\mathbfsfit}{`\J}{"1D645}%
\MathAlphabetChar{\mathbfsfit}{`\K}{"1D646}%
\MathAlphabetChar{\mathbfsfit}{`\L}{"1D647}%
\MathAlphabetChar{\mathbfsfit}{`\M}{"1D648}%
\MathAlphabetChar{\mathbfsfit}{`\N}{"1D649}%
\MathAlphabetChar{\mathbfsfit}{`\O}{"1D64A}%
\MathAlphabetChar{\mathbfsfit}{`\P}{"1D64B}%
```

```
\MathAlphabetChar{\mathbfsfit}{`\Q}{"1D64C}%
\MathAlphabetChar{\mathbfsfit}{`\R}{"1D64D}%
\MathAlphabetChar{\mathbfsfit}{`\S}{"1D64E}%
\MathAlphabetChar{\mathbfsfit}{`\T}{"1D64F}%
\MathAlphabetChar{\mathbfsfit}{`\U}{"1D650}%
\MathAlphabetChar{\mathbfsfit}{`\V}{"1D651}%
\MathAlphabetChar{\mathbfsfit}{`\W}{"1D652}%
\MathAlphabetChar{\mathbfsfit}{`\X}{"1D653}%
\MathAlphabetChar{\mathbfsfit}{`\Y}{"1D654}%
\MathAlphabetChar{\mathbfsfit}{`\Z}{"1D655}%
\MathAlphabetChar{\mathbfsfit}{`\a}{"1D656}%
\MathAlphabetChar{\mathbfsfit}{`\b}{"1D657}%
\MathAlphabetChar{\mathbfsfit}{`\c}{"1D658}%
\MathAlphabetChar{\mathbfsfit}{`\d}{"1D659}%
\MathAlphabetChar{\mathbfsfit}{`\e}{"1D65A}%
\MathAlphabetChar{\mathbfsfit}{`\f}{"1D65B}%
\MathAlphabetChar{\mathbfsfit}{`\g}{"1D65C}%
\MathAlphabetChar{\mathbfsfit}{`\h}{"1D65D}%
\MathAlphabetChar{\mathbfsfit}{`\i}{"1D65E}%
\MathAlphabetChar{\mathbfsfit}{`\j}{"1D65F}%
\MathAlphabetChar{\mathbfsfit}{`\k}{"1D660}%
\MathAlphabetChar{\mathbfsfit}{`\l}{"1D661}%
\MathAlphabetChar{\mathbfsfit}{`\m}{"1D662}%
\MathAlphabetChar{\mathbfsfit}{`\n}{"1D663}%
\MathAlphabetChar{\mathbfsfit}{`\o}{"1D664}%
\MathAlphabetChar{\mathbfsfit}{`\p}{"1D665}%
\MathAlphabetChar{\mathbfsfit}{`\q}{"1D666}%
\MathAlphabetChar{\mathbfsfit}{`\r}{"1D667}%
\MathAlphabetChar{\mathbfsfit}{`\s}{"1D668}%
\MathAlphabetChar{\mathbfsfit}{`\t}{"1D669}%
\MathAlphabetChar{\mathbfsfit}{`\u}{"1D66A}%
\MathAlphabetChar{\mathbfsfit}{`\v}{"1D66B}%
\MathAlphabetChar{\mathbfsfit}{`\w}{"1D66C}%
\MathAlphabetChar{\mathbfsfit}{`\x}{"1D66D}%
\MathAlphabetChar{\mathbfsfit}{`\y}{"1D66E}%
\MathAlphabetChar{\mathbfsfit}{`\z}{"1D66F}%
```

Greek letters:

```
\MathAlphabetChar{\mathbfsfit}{913}{"1D790}% Alpha
\MathAlphabetChar{\mathbfsfit}{914}{"1D791}% Beta
\MathAlphabetChar{\mathbfsfit}{915}{"1D792}% Gamma
\MathAlphabetChar{\mathbfsfit}{916}{"1D793}% Delta
\MathAlphabetChar{\mathbfsfit}{917}{"1D794}% Epsilon
\MathAlphabetChar{\mathbfsfit}{918}{"1D795}% Zeta
\MathAlphabetChar{\mathbfsfit}{919}{"1D796}% Eta
\MathAlphabetChar{\mathbfsfit}{920}{"1D797}% theta
\MathAlphabetChar{\mathbfsfit}{921}{"1D798}% iota
```

```
\MathAlphabetChar{\mathbfsfit}{922}{"1D799}% kappa
\MathAlphabetChar{\mathbfsfit}{923}{"1D79A}% lambda
\MathAlphabetChar{\mathbfsfit}{924}{"1D79B}% mu
\MathAlphabetChar{\mathbfsfit}{925}{"1D79C}% nu
\MathAlphabetChar{\mathbfsfit}{926}{"1D79D}% xi
\MathAlphabetChar{\mathbfsfit}{927}{"1D79E}% omicron
\MathAlphabetChar{\mathbfsfit}{928}{"1D79F}% pi
\MathAlphabetChar{\mathbfsfit}{929}{"1D7A0}% rho
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7A1}% VAR theta
\MathAlphabetChar{\mathbfsfit}{931}{"1D7A2}% sigma
\MathAlphabetChar{\mathbfsfit}{932}{"1D7A3}% tau
\MathAlphabetChar{\mathbfsfit}{933}{"1D7A4}% upsilon
\MathAlphabetChar{\mathbfsfit}{934}{"1D7A5}% phi
\MathAlphabetChar{\mathbfsfit}{935}{"1D7A6}% chi
\MathAlphabetChar{\mathbfsfit}{936}{"1D7A7}% psi
\MathAlphabetChar{\mathbfsfit}{937}{"1D7A8}% omega
\MathAlphabetChar{\mathbfsfit}{"2207}{"1D7A9}% NABLA
```

Greek lowercase:

```
\MathAlphabetChar{\mathbfsfit}{945}{"1D7AA}%
\MathAlphabetChar{\mathbfsfit}{946}{"1D7AB}%
\MathAlphabetChar{\mathbfsfit}{947}{"1D7AC}%
\MathAlphabetChar{\mathbfsfit}{948}{"1D7AD}%
\MathAlphabetChar{\mathbfsfit}{949}{"1D7AE}%
\MathAlphabetChar{\mathbfsfit}{950}{"1D7AF}%
\MathAlphabetChar{\mathbfsfit}{951}{"1D7B0}%
\MathAlphabetChar{\mathbfsfit}{952}{"1D7B1}%
\MathAlphabetChar{\mathbfsfit}{953}{"1D7B2}%
\MathAlphabetChar{\mathbfsfit}{954}{"1D7B3}%
\MathAlphabetChar{\mathbfsfit}{955}{"1D7B4}%
\MathAlphabetChar{\mathbfsfit}{956}{"1D7B5}%
\MathAlphabetChar{\mathbfsfit}{957}{"1D7B6}%
\MathAlphabetChar{\mathbfsfit}{958}{"1D7B7}%
\MathAlphabetChar{\mathbfsfit}{959}{"1D7B8}%
\MathAlphabetChar{\mathbfsfit}{960}{"1D7B9}%
\MathAlphabetChar{\mathbfsfit}{961}{"1D7BA}%
\MathAlphabetChar{\mathbfsfit}{960}{"1D7BB}% VAR SIGMA
\MathAlphabetChar{\mathbfsfit}{963}{"1D7BC}%
\MathAlphabetChar{\mathbfsfit}{964}{"1D7BD}%
\MathAlphabetChar{\mathbfsfit}{965}{"1D7BE}%
\MathAlphabetChar{\mathbfsfit}{966}{"1D7BF}%
\MathAlphabetChar{\mathbfsfit}{967}{"1D7C0}%
\MathAlphabetChar{\mathbfsfit}{968}{"1D7C1}%
\MathAlphabetChar{\mathbfsfit}{969}{"1D7C2}%
\MathAlphabetChar{\mathbfsfit}{"2202}{"1D7C3}% PARTIAL
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7C4}% VAR EPSILON
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7C5}% VAR THETA
```

```
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7C6}% VAR KAPPA
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7C7}% VAR PHI
%\MathAlphabetChar{\mathbfsfit}{??}{"1D7C8}% VAR RHO
%\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`). 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.

```
#!/bin/sh

cat stix-tbl.asc |
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!)…

```
 {if (usv != substr($0,2,5) && substr($0,2,1) != " ")
    {usv = substr($0,2,5);
     texname = substr($0,84,25);
     class = substr($0,57,1);
     description = tolower(substr($0,233,350));
```

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

```
     if (texname      ~ /[\\]/ &&
         class       != " "    &&
         description !~ /<reserved>/ )
```

Print the actual entry corresponding to the unicode character:

```
     print "\\UnicodeMathSymbol{\"" \
           usv "}{" \
           texname "}{" \
           class "}{" \
           description "}";
    }}' - |
```

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

```
sed -e ' s/{N}/{\\mathord}/   ' \
```

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`.

```
    -e ' s/{F}/{\\mathord}/   ' \
    -e ' s/{A}/{\\mathalpha}/ ' \
    -e ' s/{P}/{\\mathpunct}/ ' \
    -e ' s/{B}/{\\mathbin}/   ' \
    -e ' s/{R}/{\\mathrel}/   ' \
    -e ' s/{L}/{\\mathop}/    ' \
    -e ' s/{O}/{\\mathopen}/  ' \
    -e ' s/{C}/{\\mathclose}/ ' > unicode-math.tex
```

A Documenting maths support in the NFSS

A.1 Overview

In the following, ⟨*NFSS decl.*⟩ stands for something like `{T1}{lmr}{m}{n}`.

Maths symbol fonts Fonts for symbols: $\propto$, $\leq$, $\rightarrow$

`\DeclareSymbolFont{`⟨*name*⟩`}`⟨*NFSS decl.*⟩
Declares a named maths font such as `operators` from which symbols are defined with `\DeclareMathSymbol`.

Maths alphabet fonts Fonts for $ABC - xyz$, $\mathfrak{ABC} - \mathfrak{XYZ}$, etc.

`\DeclareMathAlphabet{`⟨*cmd*⟩`}`⟨*NFSS decl.*⟩

For commands such as `\mathbf`, accessed through maths mode that are unaffected by the current text font, and which are used for alphabetic symbols in the ASCII range.

`\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 XeTeX. The syntax used in LaTeX'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 XeTeX.

Accents are not included yet.

A.2 Detailed code investigation

This section contains an abridged and documented version of (bits and pieces of) LaTeX'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`

```
\def\DeclareMathSymbol#1#2#3#4{%
```

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

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

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

```
    \begingroup
      \count\z@=#4\relax
      \count\tw@\count\z@
      \divide\count\z@\sixt@@n
      \count@\count\z@
      \multiply\count@\sixt@@n
      \advance\count\tw@-\count@
```

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

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

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

```
        \ifin@
          \expandafter\set@mathsymbol
             \csname sym#3\endcsname#1#2%
             {\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
          \@font@info{Redeclaring math symbol \string#1}%
```

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

```
        \else
            \expandafter\ifx
            \csname\expandafter\@gobble\string#1\endcsname
            \relax
            \expandafter\set@mathsymbol
               \csname sym#3\endcsname#1#2%
               {\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
          \else
            \@latex@error{Command `\string#1' already defined}\@eha
          \fi
        \fi
```

And if the symbol input is a character:

```
      \else
        \expandafter\set@mathchar
          \csname sym#3\endcsname#1#2
          {\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
      \fi
    \endgroup
```

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

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

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

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

Or if it's for a character:

```
\def\set@mathchar#1#2#3#4{%
  \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`

```
\def\DeclareMathDelimiter#1{%
  \if\relax\noexpand#1%
    \expandafter\@DeclareMathDelimiter
  \else
    \expandafter\@xxDeclareMathDelimiter
  \fi
  #1}
\@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.

```
\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!

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

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

```
       \expandafter\@firstofone
     \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.

```
      \endgroup
      \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.

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

`\@DeclareMathDelimiter`

```
\def\@DeclareMathDelimiter#1#2#3#4#5#6{%
  \expandafter\in@\csname sym#3\expandafter\endcsname
     \expandafter{\group@list}%
  \ifin@
    \expandafter\in@\csname sym#5\expandafter\endcsname
       \expandafter{\group@list}%
    \ifin@
      \begingroup
        \count\z@=#4\relax
        \count\tw@\count\z@
        \divide\count\z@\sixt@@n
        \count@\count\z@
        \multiply\count@\sixt@@n
        \advance\count\tw@-\count@
        \edef\reserved@c{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
      %
        \count\z@=#6\relax
        \count\tw@\count\z@
        \divide\count\z@\sixt@@n
        \count@\count\z@
        \multiply\count@\sixt@@n
        \advance\count\tw@-\count@
        \edef\reserved@d{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
      %
        \edef\reserved@a{\noexpand\in@{\string\delimiter}{\meaning#1}}%
        \reserved@a
        \ifin@
          \expandafter\set@mathdelimiter
             \csname sym#3\expandafter\endcsname
             \csname sym#5\endcsname#1#2%
             \reserved@c\reserved@d
          \@font@info{Redeclaring math delimiter \string#1}%
        \else
```

```
            \expandafter\ifx
            \csname\expandafter\@gobble\string#1\endcsname
            \relax
            \expandafter\set@mathdelimiter
              \csname sym#3\expandafter\endcsname
              \csname sym#5\endcsname#1#2%
              \reserved@c\reserved@d
          \else
            \@latex@error{Command `\string#1' already defined}\@eha
          \fi
        \fi
      \endgroup
    \else
      \@latex@error{Symbol font `#5' is not defined}\@eha
    \fi
  \else
    \@latex@error{Symbol font `#3' is not defined}\@eha
  \fi
}
\@onlypreamble\@DeclareMathDelimiter
```

\@xDeclareMathDelimiter

```
\def\@xDeclareMathDelimiter#1#2#3#4#5{%
  \expandafter\in@\csname sym#2\expandafter\endcsname
     \expandafter{\group@list}%
  \ifin@
    \expandafter\in@\csname sym#4\expandafter\endcsname
       \expandafter{\group@list}%
    \ifin@
      \begingroup
        \count\z@=#3\relax
        \count\tw@\count\z@
        \divide\count\z@\sixt@@n
        \count@\count\z@
        \multiply\count@\sixt@@n
        \advance\count\tw@-\count@
        \edef\reserved@c{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
      %
        \count\z@=#5\relax
        \count\tw@\count\z@
        \divide\count\z@\sixt@@n
        \count@\count\z@
        \multiply\count@\sixt@@n
        \advance\count\tw@-\count@
        \edef\reserved@d{\hexnumber@{\count\z@}\hexnumber@{\count\tw@}}%
        \expandafter\set@@mathdelimiter
           \csname sym#2\expandafter\endcsname\csname sym#4\endcsname#1%
```

```
            \reserved@c\reserved@d
        \endgroup
      \else
        \@latex@error{Symbol font `#4' is not defined}\@eha
      \fi
    \else
      \@latex@error{Symbol font `#2' is not defined}\@eha
    \fi
}
\@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 contructs involving `\abovewithdelims` will prematurely end (pr/1329)

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

`\set@@mathdelimiter`

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

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

First check that the font encoding is defined.

```
  \@tempswafalse
  \edef\reserved@b{#2}%
  \def\cdp@elt##1##2##3##4{\def\reserved@c{##1}%
       \ifx\reserved@b\reserved@c \@tempswatrue\fi}%
  \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`.)

```
  \if@tempswa
    \@ifundefined{sym#1}{%
```

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

If the symbol font has been already declared:

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

[Update the group list.]

```
      \def\group@elt##1##2{%
           \noexpand\group@elt\noexpand##1%
           \expandafter\ifx\csname sym#1\endcsname##1%
             \expandafter\noexpand\csname#2/#3/#4/#5\endcsname
           \else
               \noexpand##2%
           \fi}%
      \xdef\group@list{\group@list}%
```

[Update the version list.]

```
      \def\version@elt##1{%
          \expandafter
          \SetSymbolFont@\expandafter##1\csname#2/#3/#4/#5\expandafter
              \endcsname \csname sym#1\endcsname
          }%
      \version@list
     }%
```

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

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

```
\def\new@symbolfont#1#2#3#4#5{%
```

Update the group list:

```
    \toks@\expandafter{\group@list}%
    \edef\group@list{\the\toks@\noexpand\group@elt\noexpand#1%
                     \expandafter\noexpand\csname#2/#3/#4/#5\endcsname}%
    \def\version@elt##1{\toks@\expandafter{##1}%
                   \edef##1{\the\toks@\noexpand\getanddefine@fonts
                   #1\expandafter\noexpand\csname#2/#3/#4/#5\endcsname}%
                  \global\advance\csname c@\expandafter
                                 \@gobble\string##1\endcsname\@ne
                }%
    \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`

```
\def\SetSymbolFont#1#2#3#4#5#6{%
 \@tempswafalse
 \edef\reserved@b{#3}%
 \def\cdp@elt##1##2##3##4{\def\reserved@c{##1}%
      \ifx\reserved@b\reserved@c \@tempswatrue\fi}%
 \cdp@list
 \if@tempswa
  \expandafter\SetSymbolFont@
    \csname mv@#2\expandafter\endcsname\csname#3/#4/#5/#6\expandafter
    \endcsname \csname sym#1\endcsname
 \else
  \@latex@error{Encoding scheme  `#3' unknown}\@eha
 \fi
}
```

`\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`

```
\def\SetSymbolFont@#1#2#3{%
```

If the maths version has been defined:

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

If the symbol font has been defined:

```
    \expandafter\in@\expandafter#3\expandafter{\group@list}%
    \ifin@
      \begingroup
        \expandafter\get@cdp\string#2\@nil\reserved@a
        \toks@{}%
        \def\install@mathalphabet##1##2{%
             \addto@hook\toks@{\install@mathalphabet##1{##2}}%
           }%
        \def\getanddefine@fonts##1##2{%
          \ifnum##1=#3%
             \addto@hook\toks@{\getanddefine@fonts#3#2}%
             \expandafter\get@cdp\string##2\@nil\reserved@b
             \ifx\reserved@a\reserved@b\else
                \@font@warning{Encoding `\reserved@b' has changed
                    to `\reserved@a' for symbol font\MessageBreak
```

```
                    `\expandafter\@gobblefour\string#3' in the
                     math version `\expandafter
                     \@gobblefour\string#1'}%
            \fi
            \@font@info{%
               Overwriting symbol font
               `\expandafter\@gobblefour\string#3' in
                version `\expandafter
               \@gobblefour\string#1'\MessageBreak
               \@spaces \expandafter\@gobble\string##2 -->
                        \expandafter\@gobble\string#2}%
         \else
            \addto@hook\toks@{\getanddefine@fonts##1##2}%
         \fi}%
        #1%
        \xdef#1{\the\toks@}%
     \endgroup
```

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

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

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

```
 \else
   \@latex@error{Math version `\expandafter\@gobblefour\string#1'
      is not
      defined}{You probably mispelled the name of the math
      version.^^JOr you have to specify an additional package.}%
 \fi}
```