The **flexisym** package

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Feedback: [https://github.com/wspr/breqn/issues](https://github.com/wspr/breqn/issues)

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User’s guide

For now, the user’s guide is in breqn.

Implementation

1 flexisym

```latex
\RequirePackage{expl3}[2009/08/05]
\ProvidesExplPackage{flexisym}{2020/09/24}{0.98k}{Make math characters macros}
\edef\do{% 
\noexpand\AtEndOfPackage{% 
\catcode\number"=\number\catcode\" 
\relax 
\}% }
\do \let\do\relax
\catcode\{"=12
\let@sym\@gobble
\DeclareOption{robust}{% 
\def@sym#1{% 
\ifx\protect@typeset@protect \else\protect\exp_after:wN\use_none:nnnn\fi 
}\)
%
}
\do \let\do\relax
\catcode\{"=12
\let@sym\@gobble
\DeclareOption{robust}{% 
\def@sym#1{% 
\ifx\protect@typeset@protect \else\protect\exp_after:wN\use_none:nnnn\fi 
}\)
%
}

The math groups (mg) here relate to \textfont n.
\def\mg@bin{2}% binary operators
\def\mg@rel{2}% relations
\def\mg@nre{B}% negated relations
\def\mg@del{3}% delimiters
```

1
This is how we insert mathchars. The command has three arguments: class, fam and slot position and so it is always given as hexadecimal. This way of separating things should make it easier to get this to work with XeTeX et al. which have many more slot positions.

\cs_set_protected:Nn \math_char:NNn { \tex_mathchar:D \__int_eval:w " #1#2#3 \__int_eval_end: }

Delimiters and radicals are similar except here we have both small and large variant. Radicals have no class.

\cs_set_protected:Nn \math_delimiter:NNnNn { \tex_delimiter:D \__int_eval:w " #1#2#3#4#5 \__int_eval_end: }

\cs_set_protected:Nn \math_radical:NnNn { \tex_radical:D \__int_eval:w " #1#2#3#4 \__int_eval_end: }

\cs_set_protected:Nn \math_accent:NNnn { \tex_mathaccent:D \__int_eval:w " #1 #2 #3 \__int_eval_end: {#4} }

TEX defines eight types of atoms.

0. Ordinary
1. Operators
2. Binary
3. Relation
4. Open
5. Close
6. Punctuation
7. Inner
TEX defines eight math classes.

0. Ordinary
1. Operators
2. Binary
3. Relation
4. Open
5. Close
6. Punctuation
7. Variable family

flexisym/breqn extends this to types of classes.

0. Ordinary: (Ord), Bidirectional delimiters (DeB), Radicals (Rad), Accented items (Acc)
1. Operators: Cumulative Operators sum-like (COs), Cumulative Operators integral-like (COi)
2. Binary: (Bin)
3. Relation: (Rel), Arrow delimiters (DeA)
4. Open: (DeL)
5. Close (DeR)
6. Punctuation: (Pun)
7. Variable family: (Var)

Here’s an overview of what we are about to do. Math chars of each type as defined by us need a basic operation for inserting it. We will call that function \math_bsym_{\langle type\rangle}:Nn. Next there are compound symbols for each type which we name \math_bcsym_{\langle type\rangle}:Nn. Also, there is inline mode and display mode which are different. We will call them for \math_isym_{\langle type\rangle}:Nn \math_icsym_{\langle type\rangle}:Nn for inline mode and \math_dsym_{\langle type\rangle}:Nn and \math_dcsym_{\langle type\rangle}:Nn. The code uses the terms \math_sym_{\langle type\rangle}:Nn and \math_csym_{\langle type\rangle}:Nn for the current meaning of things. First up the basic definitions. #1 is the math group it is from and #2 is the slot position.

\cs_new:Npn \math_bsym_Ord:Nn {\math_char:NNn 0 }\% \m@Ord
\cs_new:Npn \math_bsym_Var:Nn {\math_char:NNn 7 }\% \m@Var
\cs_new:Npn \math_bsym_Bin:Nn {\math_char:NNn 2 }\% \m@Bin
\cs_new:Npn \math_bsym_Rel:Nn {\math_char:NNn 3 }\% \m@Bin
\cs_new:Npn \math_bsym_Pun:Nn {\math_char:NNn 6 }\% \m@Pun
Next is somewhat complicated internally. The way it is done is that delimiters and radicals need information about the smallest version of the symbol. If this smallest delimiter (SD) is defined, then use it. We have these functions to help us return the number. Extract the numbers to use and stick a function in front of it.

Code changed because now we require the smallest delimiter to be defined (it may be the same, no problem in that). So the two arguments present in \math_bsym_DeL:Nn are the location of extensible version (where the font will do the rest for us automatically). For each delimiter, a pointer is defined using the extensible characters family and slot as name and value equal to family and position of the smallest version. For \texttt{(in standard L\TeX this is \{del\}{00} and \{OT1\}{28}} respectively. Hence, \math_bsym_DeL:Nn \mg@del {00} must expand to \math_delimiter:NNnNn 4 \mg@OT1 {28} \mg@del{00}. So first expand away to get to the smallest version. Then call next function which shuffles the arguments around.
The inline variants, using the basic operations. Currently we do not do anything to inline math.

The display variants, using the basic operations. Currently we do not do
anything to inline math.
\cs_new:Npn \math_dsym_Ord:Nn { \math_bsym_Ord:Nn }
\cs_new:Npn \math_dsym_Var:Nn { \math_bsym_Var:Nn }
\cs_new:Npn \math_dsym_Bin:Nn { \math_bsym_Bin:Nn }
\cs_new:Npn \math_dsym_Rel:Nn { \math_bsym_Rel:Nn }
\cs_new:Npn \math_dsym_Pun:Nn { \math_bsym_Pun:Nn }
\cs_new:Npn \math_dsym_COs:Nn { \math_bsym_COs:Nn }
\cs_new:Npn \math_dsym_COi:Nn { \math_bsym_COi:Nn }
\cs_new:Npn \math_dsym_DeL:Nn { \math_bsym_DeL:Nn }
\cs_new:Npn \math_dsym_DeR:Nn { \math_bsym_DeR:Nn }
\cs_new:Npn \math_dsym_DeB:Nn { \math_bsym_DeB:Nn }
\cs_new:Npn \math_dsym_DeA:Nn { \math_bsym_DeA:Nn }
\cs_new:Npn \math_dsym_Rad:Nn { \math_bsym_Rad:Nn }
\cs_new:Npn \math_dsym_Acc:Nn { \math_bsym_DeL:Nn }
\cs_set_protected:Npn \math_dcsym_Ord:Nn { \math_bcsym_Ord:Nn }
\cs_set_protected:Npn \math_dcsym_Var:Nn { \math_bcsym_Var:Nn }
\cs_set_protected:Npn \math_dcsym_Bin:Nn { \math_bcsym_Bin:Nn }
\cs_set_protected:Npn \math_dcsym_Rel:Nn { \math_bcsym_Rel:Nn }
\cs_set_protected:Npn \math_dcsym_Pun:Nn { \math_bcsym_Pun:Nn }
\cs_set_protected:Npn \math_dcsym_COi:Nn { \math_bcsym_COi:Nn }
\cs_set_protected:Npn \math_dcsym_COs:Nn { \math_bcsym_COs:Nn }
\cs_set_protected:Npn \math_dcsym_DeL:Nn { \math_bcsym_DeL:Nn }
\cs_set_protected:Npn \math_dcsym_DeR:Nn { \math_bcsym_DeR:Nn }
\cs_set_protected:Npn \math_dcsym_DeB:Nn { \math_bcsym_DeB:Nn }
\cs_set_protected:Npn \math_dcsym_DeA:Nn { \math_bcsym_DeA:Nn }
\cs_set_protected:Npn \math_dcsym_Acc:Nn { \math_bcsym_DeL:Nn }
\cs_set_protected:Npn \math_dcsym_Ope:Nn { \math_bcsym_Ope:Nn }
\cs_set_protected:Npn \math_dcsym_Clo:Nn { \math_bcsym_Clo:Nn }
\cs_set_protected:Npn \math_dcsym_Inn:Nn { \math_bcsym_Inn:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Ord:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Var:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Bin:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Rel:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Pun:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_COs:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_COi:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_DeL:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_DeR:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_DeB:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_DeA:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Rad:Nn }
\cs_set:Npn \math_setup_inline_symbols: { \math_isym_Acc:Nn }
Almost ready now! Now just need two commands to initialize these settings.
\cs_set:Npn \math_setup_inline_symbols: {
\cs_set_eq:NN \math_sym_Ord:Nn \math_isym_Ord:Nn
\cs_set_eq:NN \math_sym_Var:Nn \math_isym_Var:Nn
\cs_set_eq:NN \math_sym_Bin:Nn \math_isym_Bin:Nn
\cs_set_eq:NN \math_sym_Rel:Nn \math_isym_Rel:Nn
\cs_set_eq:NN \math_sym_Pun:Nn \math_isym_Pun:Nn
\cs_set_eq:NN \math_sym_COs:Nn \math_isym_COs:Nn
\cs_set_eq:NN \math_sym_COi:Nn \math_isym_COi:Nn
\cs_set_eq:NN \math_sym_DeL:Nn \math_isym_DeL:Nn
\cs_set_eq:NN \math_sym_DeR:Nn \math_isym_DeR:Nn
\cs_set_eq:NN \math_sym_DeB:Nn \math_isym_DeB:Nn
\cs_set_eq:NN \math_sym_DeA:Nn \math_isym_DeA:Nn
\cs_set_eq:NN \math_sym_Rad:Nn \math_isym_Rad:Nn
\cs_set_eq:NN \math_sym_Acc:Nn \math_isym_DeL:Nn
\cs_set_eq:NN \math_csym_Ord:Nn \math_icsym_Ord:Nn
\cs_set_eq:NN \math_csym_Var:Nn \math_icsym_Var:Nn
\cs_set_eq:NN \math_csym_Bin:Nn \math_icsym_Bin:Nn
Phew, that was it.

Well, almost. We need to set them up for use properly. Should they be added to \texttt{\everymath}? Probably, for math within displays. However, this is a lot of extra processing which we could tackle in the display setup.
\math_setup_inline_symbols:

Need an active character for a second. Don’t rely on \textasciitilde being active!

\edef\tmp{\catcode\z@=\the\catcode\z@}
\catcode\z@=\active
\def\DeclareFlexSymbol#1#2#3#4{% 
  \begingroup 
  \cs_set_protected:Npx\@tempb{ \exp_not:N\@sym\exp_not:N#1\exp_not:c{math_sym_#2:Nn} \exp_not:c{mg@#3}{#4} 
    } 
  \ifcat\exp_not:N#1\relax 
    \sym@global\let#1\@tempb 
  \else 
    \sym@global\mathcode\z@=8000\relax \lccode\z@=#1\relax \lowercase{\sym@global\let\^\@tempb}\relax % zero char 
  \fi 
  \endgroup 
} 
\tmp % restore catcode
\cs_set:Npn \DeclareFlexDelimiter #1#2#3#4#5#6{ \DeclareFlexSymbol{#1}{#2}{#3}{#4} \cs_gset:cpx{sd@\use:c{mg@#3}#4}{\exp_not:c{mg@#5}{#6}} }
\DeclareFlexCompoundSymbol{\cdots}{Inn}{\cdotp\cdotp\cdotp} \def\@symInn#1#2{\@symtype\mathinner{\OrdSymbol{#2}}}
\@symtype \mathinner{\OrdSymbol{\cdotp\cdotp\cdotp}}
\def\DeclareFlexCompoundSymbol#1#2#3{% \\exp_args:NNo \DeclareRobustCommand#1{\csname math_csym_#2:Nn\endcsname#1{#3}}% \sym@global\let#1#1\relax 
} 
\DeclareRobustCommand\textchar{\text@char\textfont} \DeclareRobustCommand\scriptchar{\text@char\scriptfont}

Simplified the next bit because now the slot is read as one argument so no afterassignment and what have you. Just drop the char directly.

\def\text@char@sym#1#2#3#4{% \begingroup 
  \cs_set_eq:NN \@sym \prg_do_nothing \relax % defense against infinite loops 
  \the\text@script@char#3% \char"#4\endgroup 
} 
\edef\tmp{\catcode\z@=\the\catcode\z@}
\catcode\z@=\active
\def\text@char#1#2{% \check@mathfonts 
  \cs_set_eq:NN \@sym \prg_do_nothing \relax % defense against infinite loops 
  \the\text@script@char#3\relax % defense against infinite loops 
  \char"#4\endgroup 
}
Hey, this looks like a simple case switch...

```latex
\def\binrel@sym#1#2#3#4{% 
  \ifx\math_sym_Ord:Nn #2 \math_csym_Ord:Nn 
  \else\ifx\math_sym_Var:Nn#2 \math_csym_Var:Nn 
  \else\ifx\math_sym_COs:Nn#2 \math_csym_COs:Nn 
  \else\ifx\math_sym_COi:Nn#2 \math_csym_COi:Nn 
  \else\ifx\math_sym_Bin:Nn#2 \math_csym_Bin:Nn 
  \fi\fi\fi\fi\fi\fi\fi\fi
\fi
\endgroup 
}\tmp % restore catcode
\providecommand\textprime{}
\DeclareRobustCommand\textprime{
\leavevmode 
\raise.8ex\hbox{\text@char\scriptfont\prime}}
\@ifundefined{resetMathstrut@}{}{%
  \def\resetMathstrut@{% 
    \setbox\z@\hbox{\textchar\vert}% 
    \ht\Mathstrutbox@\ht\z@ \dp\Mathstrutbox@\dp\z@
  }%
}

Arrow fills. changed to 7mu as in amsmath
\@ifundefined{rightarrowfill@}{}{%
  \def\rightarrowfill@#1{
    \m@th\setboxz@h{$#1\relbar$}
    \ht\z@\z@
    \hfill
    \OrdSymbol{\rightarrow} 
  }
}
\def\leftarrowfill@#1{
  \m@th\setboxz@h{$#1\relbar$}
  \ht\z@\z@
  \hfill
  \OrdSymbol{\leftarrow} 
}
\def\leftrightarrowfill@#1{
  \m@th\setboxz@h{$#1\relbar$}
  \ht\z@\z@
  \hfill
  \OrdSymbol{\leftrightarrow} 
}
```
Read delimited argument here. We want to find first character of DeA, Bin, etc. and the control sequence checked again is \m@DeL, \m@Pun, etc. The lccode trick makes the . into an @ with catcode 12. This is what results when the code is called with \string. Beware of this when we change internal names for math groups! If a Delimiter is found, insert it with class 0 but use the smallest version available. Otherwise just insert math char of class 0. The code here is not pretty and it indicates it should be tackled differently!
Before declaring any math characters active, we have to take care of a small problem with amsmath v2.x, if it is loaded before flexisym. \std@minus and \std@equal are defined as
\mathchardef\std@minus\mathcode'\-elax
\mathchardef\std@equal\mathcode'\=}\relax

in amsmath.sty and again \AtBeginDocument. The latter is because

In case some alternative math fonts are loaded later. \[amsmath.dtx]\]

The problem arises because flexisym sets the mathcode of all symbols to 32768 which is illegal for a \mathchardef.

We have to remove the assignments from the \AtBeginDocument hook as they will cause an error there.
\ifpackageloaded{amsmath}{%
Split the contents of \@begindocumenthook by reading what we search for as a delimited argument and ensure these two assignments do not take place. It is questionable if anything reasonable can be done to them. In the case of a package such as mathpazo which defines
\DeclareMathSymbol{=}\{\mathrel\}{}\{"3D}\}

the \Relbar will look wrong if we don’t use the correct symbol. The way to solve this is define additional .sym files which contain the definition of \relbar and \Relbar needed. We need those additional files anyway for things like \joinord.
\}{}

There is problem when using \DeclareMathOperator as the operators defined call a command \newmcode@ which relies on the mathcode of – being less than 32768. We delay the definition \AtBeginDocument in case amssymb hasn’t been loaded yet.
\AtBeginDocument{%
% \ifx\mathcode\undefined
gdef\newmcode@{\mathcode'\39\mathcode'\*42\mathcode’".613A%\}
\ifnum\mathcode’\=-45 \else
The extra check. Don’t do anything if – is math active.
/RefreshMathcode’\=-32768\space
\else
}
The extra check. Don’t do anything if - is math active.

And we then continue with the options.

And we then continue with the options.

2 cmbase, mathpazo, mathptmx

For each math font package we define a corresponding symbol file with extension sym. The Computer Modern base is called cmbase and mathpazo and mathptmx corresponds to the packages. The definitions are almost identical as they mostly concern the positions in the math font encodings. Look for differences in \joinord, \relbar and \Relbar. If you inspect the source code, you’ll see that the support for mathptmx didn’t require any work but I thought it better to create a sym file to maintain a uniform interface.
Open question on `!` and `?`: maybe they should have type ‘Pun’ instead of ‘DeR’. Need to search for uses in math in AMS archives. Or, maybe add a special ‘Clo’ type for them: non-extensible closing delimiter.

Default mathgroup setup.

```
\ExplSyntaxOn
\cs_gset:cpx {mg@OT1} \{\hexnumber@\symoperators\}
\cs_gset:cpx {mg@OML} \{\hexnumber@\symletters\}
\cs_gset:cpx {mg@OMS} \{\hexnumber@\symsymbols\}
\cs_gset:cpx {mg@OMX} \{\hexnumber@\symlargesymbols\}
\cs_gset:Npx \mg@bin \{\mg@OMS\}
\cs_gset:Npx \mg@del \{\mg@OMX\}
\cs_gset:Npx \mg@digit \{\exp_not:c{mg@OT1}\}
\cs_gset:NN \mg@latin \mg@OML
\cs_gset_eq:NN \mg@Greek \mg@latin
\cs_gset_eq:NN \mg@Greek \mg@digit
\cs_gset_eq:NN \mg@rel \mg@bin
\cs_gset_eq:NN \mg@ord \mg@bin
\cs_gset_eq:NN \mg@op \mg@del
```

Symbols from the 128-character `cmr` encoding. Paren and square bracket delimiters from this encoding are covered by the definitions in the `cmex` section, however.

```
\DeclareFlexSymbol{!} \{Pun\}{OT1}{21}
\DeclareFlexSymbol{+} \{Bin\}{OT1}{2B}
\DeclareFlexSymbol{=} \{Rel\}{OT1}{3D}
\DeclareFlexSymbol{\colon} \{Pun\}{OT1}{3A}
\DeclareFlexSymbol{\colonon} \{Rel\}{OT1}{3A}
\DeclareFlexSymbol{} \{Pun\}{OT1}{3B}
\AtBeginDocument{\DeclareFlexSymbol{=} \{Rel\}{OT1}{3D}}
```

AAMS\TeX, and therefore the amsmath package, make the uppercase Greek letters class 0 (nonvariable) instead of 7 (variable), to eliminate the glaring inconsistency
with lowercase Greek. (In plain \TeX, \texttt{\bf\Delta} works, while \texttt{\bf\delta} doesn’t.) Let us try to make them both variable (fonts permitting) instead of nonvariable.

\begin{verbatim}
\DeclareFlexSymbol{\Gamma} {Var}{Greek}{00}
\DeclareFlexSymbol{\Delta}  {Var}{Greek}{01}
\DeclareFlexSymbol{\Theta}  {Var}{Greek}{02}
\DeclareFlexSymbol{\Lambda} {Var}{Greek}{03}
\DeclareFlexSymbol{\Xi}    {Var}{Greek}{04}
\DeclareFlexSymbol{\Pi}    {Var}{Greek}{05}
\DeclareFlexSymbol{\Sigma} {Var}{Greek}{06}
\DeclareFlexSymbol{\Upsilon}{Var}{Greek}{07}
\DeclareFlexSymbol{\Phi}   {Var}{Greek}{08}
\DeclareFlexSymbol{\Psi}   {Var}{Greek}{09}
\DeclareFlexSymbol{\Omega} {Var}{Greek}{0A}
\DeclareFlexSymbol{0}      {Var}{digit}{30}
\DeclareFlexSymbol{1}      {Var}{digit}{31}
\DeclareFlexSymbol{2}      {Var}{digit}{32}
\DeclareFlexSymbol{3}      {Var}{digit}{33}
\DeclareFlexSymbol{4}      {Var}{digit}{34}
\DeclareFlexSymbol{5}      {Var}{digit}{35}
\DeclareFlexSymbol{6}      {Var}{digit}{36}
\DeclareFlexSymbol{7}      {Var}{digit}{37}
\DeclareFlexSymbol{8}      {Var}{digit}{38}
\DeclareFlexSymbol{9}      {Var}{digit}{39}
\DeclareFlexSymbol{,}     {Pun}{OML}{3B}
\DeclareFlexSymbol{.}     {Ord}{OML}{3A}
\DeclareFlexSymbol{/}     {Ord}{OML}{3D}
\DeclareFlexSymbol{<}     {Rel}{OML}{3C}
\DeclareFlexSymbol{>}     {Rel}{OML}{3E}
\end{verbatim}

Decimal digits.

\begin{verbatim}
To do: make the Var property of lc Greek work properly.
\end{verbatim}

\begin{verbatim}
\DeclareFlexSymbol{\alpha} {Var}{greek}{0B}
\DeclareFlexSymbol{\beta}  {Var}{greek}{0C}
\DeclareFlexSymbol{\gamma} {Var}{greek}{0D}
\DeclareFlexSymbol{\delta} {Var}{greek}{0E}
\DeclareFlexSymbol{\epsilon}{Var}{greek}{0F}
\DeclareFlexSymbol{\zeta}  {Var}{greek}{10}
\DeclareFlexSymbol{\eta}   {Var}{greek}{11}
\DeclareFlexSymbol{\theta} {Var}{greek}{12}
\DeclareFlexSymbol{\iota}  {Var}{greek}{13}
\DeclareFlexSymbol{\kappa} {Var}{greek}{14}
\DeclareFlexSymbol{\lambda}{Var}{greek}{15}
\DeclareFlexSymbol{\mu}    {Var}{greek}{16}
\DeclareFlexSymbol{\nu}    {Var}{greek}{17}
\DeclareFlexSymbol{\xi}    {Var}{greek}{18}
\DeclareFlexSymbol{\pi}    {Var}{greek}{19}
\DeclareFlexSymbol{\rho}   {Var}{greek}{1A}
\end{verbatim}
Note that in plain \TeX \textbackslash{imath} and \textbackslash{jmath} are not variable-font. But if a \textbackslash{j} changes font to, let’s say, sans serif or calligraphic, a dotless \textbackslash{j} in the same context should change font in the same way.
The `\ldotPun` glyph is used in constructing the `\ldots` symbol. It is just a period with a different math symbol class. `\lhookRel` and `\rhookRel` are used in a similar way for building hooked arrow symbols.

Symbols from the 128-character `cmsy` encoding.

\begin{verbatim}
\DeclareFlexSymbol{\ldotPun}{Pun}{OML}{3A}
\def\ldotp{\ldotPun}
\DeclareFlexSymbol{\lhookRel}{Rel}{OML}{2C}
\DeclareFlexSymbol{\rhookRel}{Rel}{OML}{2D}
\end{verbatim}
\DeclareFlexSymbol{|} {Ord}{OMS}{6A}
\DeclareFlexSymbol{\aleph} {Ord}{ord}{40}
\DeclareFlexSymbol{\Re} {Ord}{ord}{3C}
\DeclareFlexSymbol{\Im} {Ord}{ord}{3D}
\DeclareFlexSymbol{\infty} {Ord}{ord}{31}
\DeclareFlexSymbol{\prime} {Ord}{ord}{30}
\DeclareFlexSymbol{\emptyset} {Ord}{ord}{3B}
\DeclareFlexSymbol{\nabla} {Ord}{ord}{72}
\DeclareFlexSymbol{\top} {Ord}{ord}{3E}
\DeclareFlexSymbol{\bot} {Ord}{ord}{3F}
\DeclareFlexSymbol{\triangle} {Ord}{ord}{34}
\DeclareFlexSymbol{\forall} {Ord}{ord}{38}
\DeclareFlexSymbol{\exists} {Ord}{ord}{39}
\DeclareFlexSymbol{\neg} {Ord}{ord}{3A}
\DeclareFlexSymbol{\clubsuit} {Ord}{ord}{7C}
\DeclareFlexSymbol{\diamondsuit} {Ord}{ord}{7D}
\DeclareFlexSymbol{\heartsuit} {Ord}{ord}{7E}
\DeclareFlexSymbol{\spadesuit} {Ord}{ord}{7F}
\DeclareFlexSymbol{\smallint} {COs}{OMS}{73}

Binary operators.
\DeclareFlexSymbol{\bigtriangleup} {Bin}{bin}{34}
\DeclareFlexSymbol{\bigtriangledown} {Bin}{bin}{35}
\DeclareFlexSymbol{\wedge} {Bin}{bin}{5E}
\DeclareFlexSymbol{\vee} {Bin}{bin}{5F}
\DeclareFlexSymbol{\cap} {Bin}{bin}{5C}
\DeclareFlexSymbol{\cup} {Bin}{bin}{5B}
\DeclareFlexSymbol{\ddagger} {Bin}{bin}{7A}
\DeclareFlexSymbol{\dagger} {Bin}{bin}{79}
\DeclareFlexSymbol{\sqcap} {Bin}{bin}{75}
\DeclareFlexSymbol{\sqcup} {Bin}{bin}{74}
\DeclareFlexSymbol{\uplus} {Bin}{bin}{5D}
\DeclareFlexSymbol{\amalg} {Bin}{bin}{71}
\DeclareFlexSymbol{\diamond} {Bin}{bin}{05}
\DeclareFlexSymbol{\bullet} {Bin}{bin}{0F}
\DeclareFlexSymbol{\wr} {Bin}{bin}{6F}
\DeclareFlexSymbol{\div} {Bin}{bin}{04}
\DeclareFlexSymbol{\cdot} {Bin}{bin}{01}
\DeclareFlexSymbol{\ast} {Bin}{bin}{03}
\DeclareFlexSymbol{\times} {Bin}{bin}{02}
\DeclareFlexSymbol{\bigcirc} {Bin}{bin}{0D}
\DeclareFlexSymbol{\setminus} {Bin}{bin}{6E}
\DeclareFlexSymbol{\cdot} {Bin}{bin}{02}
Relation symbols.

\begin{verbatim}
615 \DeclareFlexSymbol\propto {Rel}{rel}{2F}
616 \DeclareFlexSymbol\sqsubseteq {Rel}{rel}{76}
617 \DeclareFlexSymbol\sqsupseteq {Rel}{rel}{77}
618 \DeclareFlexSymbol\parallel {Rel}{rel}{6B}
619 \DeclareFlexSymbol\mid {Rel}{rel}{6A}
620 \DeclareFlexSymbol\dashv {Rel}{rel}{61}
621 \DeclareFlexSymbol\vdash {Rel}{rel}{60}
622 \DeclareFlexSymbol\nearrow {Rel}{rel}{25}
623 \DeclareFlexSymbol\searrow {Rel}{rel}{26}
624 \DeclareFlexSymbol\nwarrow {Rel}{rel}{2D}
625 \DeclareFlexSymbol\swarrow {Rel}{rel}{2E}
626 \DeclareFlexSymbol\Lefttrightarrow{Rel}{rel}{2C}
627 \DeclareFlexSymbol\Leftarrow {Rel}{rel}{28}
628 \DeclareFlexSymbol\Rightarrow {Rel}{rel}{29}
629 \DeclareFlexSymbol\leq {Rel}{rel}{14}
630 \DeclareFlexSymbol\geq {Rel}{rel}{15}
631 \DeclareFlexSymbol\succ {Rel}{rel}{1F}
632 \DeclareFlexSymbol\prec {Rel}{rel}{1E}
633 \DeclareFlexSymbol\approx {Rel}{rel}{19}
634 \DeclareFlexSymbol\succeq {Rel}{rel}{17}
635 \DeclareFlexSymbol\preceq {Rel}{rel}{16}
636 \DeclareFlexSymbol\supset {Rel}{rel}{1B}
637 \DeclareFlexSymbol\subset {Rel}{rel}{1A}
638 \DeclareFlexSymbol\supseteq {Rel}{rel}{13}
639 \DeclareFlexSymbol\subseteq {Rel}{rel}{12}
640 \DeclareFlexSymbol\in {Rel}{rel}{32}
641 \DeclareFlexSymbol\ni {Rel}{rel}{33}
642 \DeclareFlexSymbol\gg {Rel}{rel}{1D}
643 \DeclareFlexSymbol\ll {Rel}{rel}{1C}
644 \DeclareFlexSymbol\leftrightarrow{Rel}{rel}{24}
645 \DeclareFlexSymbol\leftarrow {Rel}{rel}{20}
646 \DeclareFlexSymbol\rightarrow {Rel}{rel}{21}
647 \DeclareFlexSymbol\sim {Rel}{rel}{18}
648 \DeclareFlexSymbol\simeq {Rel}{rel}{27}
649 \DeclareFlexSymbol\perp {Rel}{rel}{3F}
650 \DeclareFlexSymbol\equiv {Rel}{rel}{11}
651 \DeclareFlexSymbol\asymp {Rel}{rel}{10}
\end{verbatim}

The \notRel glyph is a special zero-width glyph intended only for use in constructing negated symbols. \mapstoRel and \cdotpPun have similar but more restricted applications.

\begin{verbatim}
652 \DeclareFlexSymbol\notRel {Rel}{rel}{36}
653 \DeclareFlexSymbol\mapstoOrd{Ord}{OMS}{37}
654 \DeclareFlexSymbol\cdotp {Ord}{OMS}{01}
\end{verbatim}

Symbols from the 128-character cmex encoding. \texttt{COS} stands for ‘cumulative operator (sum-like)’. \texttt{COi} stands for ‘cumulative operator (integral-like)’. These typically differ only in the default placement of limits. \texttt{cop} stands for ‘cumulative
\begin{verbatim}
operator math group'.
\DeclareFlexSymbol{\coprod} {COs}{cop}{60}
\DeclareFlexSymbol{\bigvee} {COs}{cop}{57}
\DeclareFlexSymbol{\bigwedge} {COs}{cop}{56}
\DeclareFlexSymbol{\biguplus} {COs}{cop}{55}
\DeclareFlexSymbol{\bigcap} {COs}{cop}{54}
\DeclareFlexSymbol{\bigcup} {COs}{cop}{53}
\DeclareFlexSymbol{\int} {COi}{cop}{52}
\DeclareFlexSymbol{\prod} {COs}{cop}{51}
\DeclareFlexSymbol{\sum} {COs}{cop}{50}
\DeclareFlexSymbol{\bigotimes}{COs}{cop}{4E}
\DeclareFlexSymbol{\bigoplus} {COs}{cop}{4C}
\DeclareFlexSymbol{\bigodot} {COs}{cop}{4A}
\DeclareFlexSymbol{\oint} {COi}{cop}{48}
\DeclareFlexSymbol{\bigsqcup} {COs}{cop}{46}

Delimiter symbols. DeL stands for ‘delimiter (left)’. DeR stands for ‘delimiter (right)’. DeB stands for ‘delimiter (bidirectional)’. The principal encoding point
for an extensible delimiter is the first link in the list of linked sizes as specified in
the font metric information. For a math encoding such as OT1/OML/OMS/OMX
where not all sizes of a given delimiter reside in a given font, the extra encoding
point for the smallest delimiter must be supplied by defining
\DeclareFlexDelimiter{\rangle}{DeR}{del}{0B}{OMS}{69}
\DeclareFlexDelimiter{\langle}{DeL}{del}{0A}{OMS}{68}
\DeclareFlexDelimiter{\rbrace}{DeR}{del}{09}{OMS}{67}
\DeclareFlexDelimiter{\lbrace}{DeL}{del}{08}{OMS}{66}
\DeclareFlexDelimiter{\rceil} {DeR}{del}{07}{OMS}{65}
\DeclareFlexDelimiter{\lceil} {DeL}{del}{06}{OMS}{64}
\DeclareFlexDelimiter{\rfloor}{DeR}{del}{05}{OMS}{63}
\DeclareFlexDelimiter{\lfloor}{DeL}{del}{04}{OMS}{62}
\DeclareFlexDelimiter{(} {DeL}{del}{00}{OT1}{28}
\DeclareFlexDelimiter{)} {DeR}{del}{01}{OT1}{29}
\DeclareFlexDelimiter{[} {DeL}{del}{02}{OT1}{5B}
\DeclareFlexDelimiter{]} {DeR}{del}{03}{OT1}{5D}
\DeclareFlexDelimiter{|}{DeB}{del}{0D}{OMS}{6B}
\DeclareFlexDelimiter{/}{DeB}{del}{0E}{OML}{3D}
\end{verbatim}

where G is the mathgroup and XX is the hexadecimal glyph position. \Decla}\localexample{\DeclareFlexDelimiter{\rangle}{DeR}{del}{0B}{OMS}{69}
\DeclareFlexDelimiter{\langle}{DeL}{del}{0A}{OMS}{68}
\DeclareFlexDelimiter{\rbrace}{DeR}{del}{09}{OMS}{67}
\DeclareFlexDelimiter{\lbrace}{DeL}{del}{08}{OMS}{66}
\DeclareFlexDelimiter{\rceil} {DeR}{del}{07}{OMS}{65}
\DeclareFlexDelimiter{\lceil} {DeL}{del}{06}{OMS}{64}
\DeclareFlexDelimiter{\rfloor}{DeR}{del}{05}{OMS}{63}
\DeclareFlexDelimiter{\lfloor}{DeL}{del}{04}{OMS}{62}
\DeclareFlexDelimiter{(} {DeL}{del}{00}{OT1}{28}
\DeclareFlexDelimiter{)} {DeR}{del}{01}{OT1}{29}
\DeclareFlexDelimiter{[} {DeL}{del}{02}{OT1}{5B}
\DeclareFlexDelimiter{]} {DeR}{del}{03}{OT1}{5D}
\DeclareFlexDelimiter{|}{DeB}{del}{0D}{OMS}{6B}
\DeclareFlexDelimiter{/}{DeB}{del}{0E}{OML}{3D}
\end{verbatim}

where G is the mathgroup and XX is the hexadecimal glyph position. \Decla}\localexample{\DeclareFlexDelimiter{\rangle}{DeR}{del}{0B}{OMS}{69}
\DeclareFlexDelimiter{\langle}{DeL}{del}{0A}{OMS}{68}
\DeclareFlexDelimiter{\rbrace}{DeR}{del}{09}{OMS}{67}
\DeclareFlexDelimiter{\lbrace}{DeL}{del}{08}{OMS}{66}
\DeclareFlexDelimiter{\rceil} {DeR}{del}{07}{OMS}{65}
\DeclareFlexDelimiter{\lceil} {DeL}{del}{06}{OMS}{64}
\DeclareFlexDelimiter{\rfloor}{DeR}{del}{05}{OMS}{63}
\DeclareFlexDelimiter{\lfloor}{DeL}{del}{04}{OMS}{62}
\DeclareFlexDelimiter{(} {DeL}{del}{00}{OT1}{28}
\DeclareFlexDelimiter{)} {DeR}{del}{01}{OT1}{29}
\DeclareFlexDelimiter{[} {DeL}{del}{02}{OT1}{5B}
\DeclareFlexDelimiter{]} {DeR}{del}{03}{OT1}{5D}
\DeclareFlexDelimiter{|}{DeB}{del}{0D}{OMS}{6B}
\DeclareFlexDelimiter{/}{DeB}{del}{0E}{OML}{3D}
\end{verbatim}

where G is the mathgroup and XX is the hexadecimal glyph position. \Decla
These wacky delimiters need to be supported I guess for compatibility reasons. The DeA delimiter type is a special case used only for these arrows.

3 Some compound symbols

The following symbols are not robust in standard \LaTeX{} because they use \# or \texttt{\mathpalette} (which is not robust and contains a \# in its expansion): \texttt{\angle}, \texttt{\cong}, \texttt{\notin}, \texttt{\rightleftharpoons}.

In this definition of \texttt{\hbar}, the symbol is cobbled together from a math italic h and the cmr overbar accent glyph.

For \texttt{\surd}, the interior symbol gets math class 1 (cumulative operator) to make the glyph vertically centered on the math axis, but the desired horizontal spacing is the spacing for a mathord. (Couldn’t it just be class mathopen, though?)

As shown in this definition of \texttt{\angle}, rule dimens are not allowed to use math units, unfortunately.

The \texttt{\not} function, which is defined in the \texttt{flexisym} package, requires a suitably defined \texttt{\notRel} symbol.

\begin{verbatim}
\DeclareFlexSymbol{\hbarOrd}{Ord}{OT1}{16}
\DeclareFlexCompoundSymbol{\hbar}{Ord}{\hbarOrd\mkern-9mu h}
\end{verbatim}

\begin{verbatim}
\DeclareFlexSymbol{\surdOrd}{Ord}{OMS}{70}
\DeclareFlexCompoundSymbol{\surd}{Ord}{\mathop{\surdOrd}}
\end{verbatim}

\begin{verbatim}
\DeclareFlexCompoundSymbol{\angle}{Ord}{% \vbox{\ialign{\m@th\scriptstyle##\crcr \notRel\mathrel{\mkern14mu}\crcr \noalign{\nointerlineskip}\mkern2.5mu\leaders\hrule\ht.34pt\hfill\mkern2.5mu\crcr}}%}
\end{verbatim}

\begin{verbatim}
\DeclareFlexCompoundSymbol{\neq}{Rel}{\not{=}}
\end{verbatim}
The \@vereq function ends by centering the whole construction on the math axis, unlike \buildrel where the base symbol remains at its normal altitude. Furthermore, \@vereq leaves the math style of the top symbol as given instead of downsizing to scriptstyle.

The \m@th in the fontmath.ltx definition of \notin is superfluous unless \c@ncel doesn’t include it (which was perhaps true in an older version of plain.tex?).

\providecommand*\joinord{}

\langle cmbase | mathptmx \rangle \renewcommand*\joinord{\mkern-3mu }
\langle mathpazo \rangle \renewcommand*\joinord{\mkern-3.45mu } \renewcommand*\iff{\mskip\thickmuskip \Longleftrightarrow \mskip\thickmuskip}

Here is what you get from the old definition of \iff.

\begin{verbatim}
\texttt{\textbackslash glue 2.77771 plus 2.77771}
\texttt{\textbackslash glue(\textbackslash thickmuskip) 2.77771 plus 2.77771}
\texttt{\textbackslash OMS/cmsy/m/n/10 (}
\texttt{\textbackslash hbox(0.0+0.0)x-1.66663}
\texttt{\textbackslash kern -1.66663}
\texttt{\textbackslash OMS/cmsy/m/n/10 )}
\texttt{\penalty 500}
\texttt{\textbackslash glue 2.77771 plus 2.77771}
\texttt{\textbackslash glue(\textbackslash thickmuskip) 2.77771 plus 2.77771}
\end{verbatim}

Looks like it could be simplified slightly. But it’s not so easy as it looks to do it without screwing up the line breaking possibilities.

\begin{verbatim}
\renewcommand*\iff{%
\mskip\thickmuskip\Longlefttrightarrow\mskip\thickmuskip}
\end{verbatim}

Some dotly symbols.

\DeclareFlexCompoundSymbol{\cdots}{Inn}{\cdotp\cdotp\cdotp}\
\DeclareFlexCompoundSymbol{\vdots}{Ord}{%
The code snippet is from a LaTeX document. It appears to be a part of a larger program related to defining and using symbols in math mode. The text includes commands to define new symbols, such as `\DeclareFlexSymbol`, and discusses the usage of the `\mathpalette` command to ensure proper spacing and style.

The document starts with some initial setup for defining and adjusting symbol styles. It then proceeds to define various symbols, including `\boxdot`, `\boxplus`, `\boxtimes`, `\square`, `\blacksquare`, `\centerdot`, `\lozenge`, `\blacklozenge`, `\circlearrowright`, `\circlearrowleft`, `\rightleftharpoons`, and `\leftrightharpoons`. These definitions are tailored for different families and classes, such as `Bin`, `Ord`, and `Rel`.

The code also mentions the usage of `\mathptmx` and `cmr` fonts, indicating a focus on compatibility and stylistic consistency across different packages, such as `mathpazo` and `mathptmx`.

Finally, the document notes the importance of adjusting symbols in packages like `amsfonts` and references sources such as `flexisym` and `msabm` for additional synonyms and definitions.

The snippet ends with comments about synchronization issues and the benefits of using `\def` instead of `\let` for slower execution speed but smaller chance of synchronization problems.
in amsfonts.sty
\DeclareFlexSymbol\sqsubset \{Rel\}{MSA}{40}
\DeclareFlexSymbol\sqsupset \{Rel\}{MSA}{41}
\DeclareFlexSymbol\vartriangleright \{Rel\}{MSA}{42}
\DeclareFlexSymbol\vartriangleleft \{Rel\}{MSA}{43}
\DeclareFlexSymbol\trianglerighteq \{Rel\}{MSA}{44}
\DeclareFlexSymbol\trianglelefteq \{Rel\}{MSA}{45}
\DeclareFlexSymbol\bigstar \{Ord\}{MSA}{46}
\DeclareFlexSymbol\between \{Rel\}{MSA}{47}
\DeclareFlexSymbol\blacktriangledown \{Ord\}{MSA}{48}
\DeclareFlexSymbol\blacktriangleright \{Rel\}{MSA}{49}
\DeclareFlexSymbol\blacktriangleleft \{Rel\}{MSA}{4A}
\DeclareFlexSymbol\vartriangle \{Rel\}{MSA}{4D}
\DeclareFlexSymbol\blacktriangle \{Ord\}{MSA}{4E}
\DeclareFlexSymbol\triangledown \{Ord\}{MSA}{4F}
\DeclareFlexSymbol\eqcirc \{Rel\}{MSA}{50}
\DeclareFlexSymbol\lesseqgtr \{Rel\}{MSA}{51}
\DeclareFlexSymbol\gtreqless \{Rel\}{MSA}{52}
\DeclareFlexSymbol\lesseqqgtr \{Rel\}{MSA}{53}
\DeclareFlexSymbol\gtreqqless \{Rel\}{MSA}{54}
\DeclareFlexSymbol\Rrightarrow \{Rel\}{MSA}{56}
\DeclareFlexSymbol\Lleftarrow \{Rel\}{MSA}{57}
\DeclareFlexSymbol\veebar \{Bin\}{MSA}{59}
\DeclareFlexSymbol\barwedge \{Bin\}{MSA}{5A}
\DeclareFlexSymbol\doublebarwedge \{Bin\}{MSA}{5B}
\DeclareFlexSymbol\angle \{Ord\}{MSA}{5C}
\DeclareFlexSymbol\measuredangle \{Ord\}{MSA}{5D}
\DeclareFlexSymbol\sphericalangle \{Ord\}{MSA}{5E}
\DeclareFlexSymbol\varpropto \{Rel\}{MSA}{5F}
\DeclareFlexSymbol\smallsmile \{Rel\}{MSA}{60}
\DeclareFlexSymbol\smallfrown \{Rel\}{MSA}{61}
\DeclareFlexSymbol\Subset \{Rel\}{MSA}{62}
\DeclareFlexSymbol\Supset \{Rel\}{MSA}{63}
\DeclareFlexSymbol\Cup \{Bin\}{MSA}{64}
\let\doublecup\Cup
\DeclareFlexSymbol\Cap \{Bin\}{MSA}{65}
\let\doublecap\Cap
\DeclareFlexSymbol\curlywedge \{Bin\}{MSA}{66}
\DeclareFlexSymbol\curlyvee \{Bin\}{MSA}{67}
\DeclareFlexSymbol\leftthreetimes \{Bin\}{MSA}{68}
\DeclareFlexSymbol\rightthreetimes \{Bin\}{MSA}{69}
\DeclareFlexSymbol\subsetneqq \{Rel\}{MSA}{6A}
\DeclareFlexSymbol\supsetneqq \{Rel\}{MSA}{6B}
\DeclareFlexSymbol\bumpeq \{Rel\}{MSA}{6C}
\DeclareFlexSymbol\Bumpeq \{Rel\}{MSA}{6D}
\DeclareFlexSymbol\lll \{Rel\}{MSA}{6E}
\let\llless\lll
\DeclareFlexSymbol\ggg \{Rel\}{MSA}{6F}
\let\gggtr\ggg
\DeclareFlexSymbol{\circledS} {Ord}{MSA}{73}
\DeclareFlexSymbol{\pitchfork} {Rel}{MSA}{74}
\DeclareFlexSymbol{\dotplus} {Bin}{MSA}{75}
\DeclareFlexSymbol{\backsim} {Rel}{MSA}{76}
\DeclareFlexSymbol{\backsimeq} {Rel}{MSA}{77}
\DeclareFlexSymbol{\complement} {Ord}{MSA}{7B}
\DeclareFlexSymbol{\intercal} {Bin}{MSA}{7C}
\DeclareFlexSymbol{\circledcirc} {Bin}{MSA}{7D}
\DeclareFlexSymbol{\circledast} {Bin}{MSA}{7E}
\DeclareFlexSymbol{\circleddash} {Bin}{MSA}{7F}

Begin AMSb declarations
\DeclareFlexSymbol{\lvertneqq} {Rel}{MSB}{00}
\DeclareFlexSymbol{\gvertneqq} {Rel}{MSB}{01}
\DeclareFlexSymbol{\nleq} {Rel}{MSB}{02}
\DeclareFlexSymbol{\ngeq} {Rel}{MSB}{03}
\DeclareFlexSymbol{\nless} {Rel}{MSB}{04}
\DeclareFlexSymbol{\ngtr} {Rel}{MSB}{05}
\DeclareFlexSymbol{\nprec} {Rel}{MSB}{06}
\DeclareFlexSymbol{\nsucc} {Rel}{MSB}{07}
\DeclareFlexSymbol{\lneqq} {Rel}{MSB}{08}
\DeclareFlexSymbol{\gneqq} {Rel}{MSB}{09}
\DeclareFlexSymbol{\nleqslant} {Rel}{MSB}{0A}
\DeclareFlexSymbol{\ngeqslant} {Rel}{MSB}{0B}
\DeclareFlexSymbol{\lneq} {Rel}{MSB}{0C}
\DeclareFlexSymbol{\gneq} {Rel}{MSB}{0D}
\DeclareFlexSymbol{\npreceq} {Rel}{MSB}{0E}
\DeclareFlexSymbol{\nsucceq} {Rel}{MSB}{0F}
\DeclareFlexSymbol{\precnsim} {Rel}{MSB}{10}
\DeclareFlexSymbol{\succnsim} {Rel}{MSB}{11}
\DeclareFlexSymbol{\lnsim} {Rel}{MSB}{12}
\DeclareFlexSymbol{\gnapprox} {Rel}{MSB}{13}
\DeclareFlexSymbol{\nsim} {Rel}{MSB}{14}
\DeclareFlexSymbol{\ncong} {Rel}{MSB}{15}
\DeclareFlexSymbol{\rangle} {Rel}{MSB}{16}
\DeclareFlexSymbol{\lapprox} {Rel}{MSB}{17}
\DeclareFlexSymbol{\lapprox} {Rel}{MSB}{18}
\DeclareFlexSymbol{\approx} {Rel}{MSB}{19}
\DeclareFlexSymbol{\leq} {Rel}{MSB}{1A}
\DeclareFlexSymbol{\neq} {Rel}{MSB}{1B}
\DeclareFlexSymbol{\subsetneq} {Rel}{MSB}{1C}
\DeclareFlexSymbol{\nsimeq} {Rel}{MSB}{1D}
\DeclareFlexSymbol{\diagup} {Ord}{MSB}{1E}
\DeclareFlexSymbol{\diagdown} {Ord}{MSB}{1F}
\DeclareFlexSymbol{\subsetneq} {Rel}{MSB}{20}
\DeclareFlexSymbol{\nsimeq} {Rel}{MSB}{21}
\DeclareFlexSymbol{\nsimeq} {Rel}{MSB}{22}
\DeclareFlexSymbol{\nsimeq} {Rel}{MSB}{23}
\DeclareFlexSymbol{\subsetneq} {Rel}{MSB}{24}
\DeclareSymbol\supsetneqq {Rel}{MSB}{25}
\DeclareSymbol\varsubsetneqq {Rel}{MSB}{26}
\DeclareSymbol\varsupsetneqq {Rel}{MSB}{27}
\DeclareSymbol\subsetneq {Rel}{MSB}{28}
\DeclareSymbol\supsetneq {Rel}{MSB}{29}
\DeclareSymbol\nsubseteq {Rel}{MSB}{2A}
\DeclareSymbol\nsupseteq {Rel}{MSB}{2B}
\DeclareSymbol\nparallel {Rel}{MSB}{2C}
\DeclareSymbol\nmid {Rel}{MSB}{2D}
\DeclareSymbol\nshortmid {Rel}{MSB}{2E}
\DeclareSymbol\nshortparallel {Rel}{MSB}{2F}
\DeclareSymbol\nvdash {Rel}{MSB}{30}
\DeclareSymbol\nVdash {Rel}{MSB}{31}
\DeclareSymbol\nvDash {Rel}{MSB}{32}
\DeclareSymbol\nVDash {Rel}{MSB}{33}
\DeclareSymbol\ntrianglerighteq {Rel}{MSB}{34}
\DeclareSymbol\ntrianglelefteq {Rel}{MSB}{35}
\DeclareSymbol\ntriangleleft {Rel}{MSB}{36}
\DeclareSymbol\ntriangleright {Rel}{MSB}{37}
\DeclareSymbol\nleftarrow {Rel}{MSB}{38}
\DeclareSymbol\nrightarrow {Rel}{MSB}{39}
\DeclareSymbol\nLeftarrow {Rel}{MSB}{3A}
\DeclareSymbol\nRightarrow {Rel}{MSB}{3B}
\DeclareSymbol\nLeftrightarrow {Rel}{MSB}{3C}
\DeclareSymbol\nleftrightarrow {Rel}{MSB}{3D}
\DeclareSymbol\divideontimes {Bin}{MSB}{3E}
\DeclareSymbol\emptyset {Ord}{MSB}{3F}
\DeclareSymbol\nexists {Ord}{MSB}{40}
\DeclareSymbol\Finv {Ord}{MSB}{60}
\DeclareSymbol\Game {Ord}{MSB}{61}
\DeclareSymbol\mho {Ord}{MSB}{66}
\DeclareSymbol\eth {Ord}{MSB}{67}
\DeclareSymbol\eqsim {Rel}{MSB}{68}
\DeclareSymbol\beth {Ord}{MSB}{69}
\DeclareSymbol\gimel {Ord}{MSB}{6A}
\DeclareSymbol\daleth {Ord}{MSB}{6B}
\DeclareSymbol\lessdot {Bin}{MSB}{6C}
\DeclareSymbol\gtrdot {Bin}{MSB}{6D}
\DeclareSymbol\ltimes {Bin}{MSB}{6E}
\DeclareSymbol\rtimes {Bin}{MSB}{6F}
\DeclareSymbol\shortmid {Rel}{MSB}{70}
\DeclareSymbol\shortparallel {Rel}{MSB}{71}
\DeclareSymbol\smallsetminus {Bin}{MSB}{72}
\DeclareSymbol\thicksim {Rel}{MSB}{73}
\DeclareSymbol\thickapprox {Rel}{MSB}{74}
\DeclareSymbol\thickapprox {Rel}{MSB}{75}
\DeclareSymbol\succapprox {Rel}{MSB}{76}
\DeclareSymbol\precapprox {Rel}{MSB}{77}
Index

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

<table>
<thead>
<tr>
<th>Symbols</th>
<th>@symPun</th>
<th>@symRel</th>
<th>@symVar</th>
<th>@symextension</th>
<th>@symtype</th>
<th>@symtype@ord</th>
<th>@tempb</th>
<th>@typeset@protect</th>
<th>@undefined</th>
<th>@vereq</th>
<th>_</th>
<th>|</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;</td>
<td>7, 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'</td>
<td>365, 374</td>
<td></td>
<td></td>
<td>@symRel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>365, 374</td>
<td></td>
<td></td>
<td>@symextension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>366, 367, 369, 372, 375, 376, 378, 381 @symtype</td>
<td>83-93, 96-98, 100, 265, 344</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@tempb</td>
<td>228, 233, 237, 334, 335</td>
<td>@type</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.</td>
<td>349, 365, 374</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@tempb</td>
<td>228, 233, 237, 334, 335</td>
<td>@type</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>372, 381</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@tempb</td>
<td>228, 233, 237, 334, 335</td>
<td>@type</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>:</td>
<td>372, 381</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@symtype@ord</td>
<td>344, 346</td>
<td>@tempb</td>
<td>228, 233, 237, 334, 335</td>
<td>@type</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>@firstofone</td>
<td>100</td>
<td>@undefined</td>
<td>364</td>
<td>@vereq</td>
<td>718</td>
<td>@gobblethree</td>
<td>328</td>
<td>_</td>
<td>35, 38, 41, 44, 349</td>
<td>@height</td>
<td>713</td>
<td>|</td>
</tr>
<tr>
<td>@gobble</td>
<td>13, 346</td>
<td>@undefined</td>
<td>364</td>
<td>@vereq</td>
<td>718</td>
<td>@gobblethree</td>
<td>328</td>
<td>_</td>
<td>35, 38, 41, 44, 349</td>
<td>@height</td>
<td>713</td>
<td>|</td>
</tr>
<tr>
<td>@undefined</td>
<td>284, 290</td>
<td>@undefined</td>
<td>364</td>
<td>@vereq</td>
<td>718</td>
<td>@gobblethree</td>
<td>328</td>
<td>_</td>
<td>35, 38, 41, 44, 349</td>
<td>@height</td>
<td>713</td>
<td>|</td>
</tr>
<tr>
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27
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34