

The `mathstyle` package

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Feedback: <https://github.com/wspr/breqn/issues>

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User's guide

This package exists for two reasons:

- The primitive operations for creating a super- or subscript in \TeX work almost as if `^` and `_` are macros taking an argument. However, that is not quite the case, and some things that you'd expect to work don't (e.g., `^{\cong}`) whereas others which you'd think shouldn't work actually do (such as `^{\mathsf{s}}`). We do everyone a favor if it behaves consistently, i.e., if the superscript and subscript operations act as if they are macros taking exactly one argument.
- Because the \TeX math typesetting engine uses infix notation for fractions, one has to use `\mathchoice` or `\mathpalette` whenever trying to do anything requiring boxing or measuring math. This creates problems for loading fonts on demand as the font loading mechanism has to load fonts for all styles without even knowing if the font is going to be used. Getting the timing of `\mathchoice` right can be tricky as well. Since \LaTeX does not promote the primitive infix notation, this package keeps track of a current `mathstyle` parameter.

1 Some usage tips

If you want to use this package with `amsmath`, it is important `mathstyle` is loaded *after* `amsmath`.

The current `mathstyle` is stored in the variable `\mathstyle`. The command `\currentmathstyle` can be used to switch to the mode currently active. Below is shown how the macro `\mathrlap` from `mathtools` is implemented without knowing about the current `mathstyle` using `\mathpalette`.

```
\providecommand*\mathrlap[1][]{%  
  \ifx\@empty#1\@empty
```

```

\expandafter \mathpalette \expandafter \@mathrlap
\else
\expandafter \@mathrlap \expandafter #1%
\fi}
\providecommand*\@mathrlap #1#2{{}\rlap{$\m@th#1{#2}$}}

```

The same definition using `\currentmathstyle` from this package.

```

\providecommand*\mathrlap[2][]{%
#1 {} \rlap{$\m@th \currentmathstyle {#2}$}}

```

1.1 Package options

This package has one set of options affecting the `_` and `^` characters:

- `\usepackage[mathactivechars]{mathstyle}`

This is the default behaviour. Here, `_` and `^` are made into harmless characters in text mode and behave as expected (for entering sub/superscript) when inside math mode. Certain code that assumes the catcodes of these characters may get confused about this; see below for a possible fix.

- `\usepackage[activechars]{mathstyle}`

With this option, `_` and `^` are made into active characters for entering sub/superscript mode in all cases—therefore, in text mode they will produce a regular error (‘Missing \$ inserted’) indicating they are being used out of place.

- `\usepackage[noactivechars]{mathstyle}`

This is the option most like to solve any compatibility problems. Here, `_` and `^` retain their regular catcodes at all times and behave in their default fashion. **However**, certain other features of this package (such as `\currentmathstyle` inside a subscript) will then fail to work, so only use this option as a last resort.

Implementation

1 `\package`

`\@saveprimitive` A straight copy from `breqn`, see implementation details there. Of course, with a recent `pdfTeX` (v1.40+), one can just use `\primitive` to get the original. We will implement that some day.

```

2 \providecommand\@saveprimitive[2]{%
3   \begingroup
4   \edef\@tempa{\string#1}\edef\@tempb{\meaning#1}%

```

```

5 \ifx\@tempa\@tempb \global\let#2#1%
6 \else
7 \edef\@tempb{\meaning#2}%
8 \ifx\@tempa\@tempb
9 \else \@saveprimitive@a#1#2%
10 \fi
11 \fi
12 \endgroup
13 }
14 \providecommand\@saveprimitive@a[2]{%
15 \begingroup
16 \def\@tempb##1#1##2{\edef\@tempb{##2}\@car{}}%
17 \@tempb\nullfont{select font nullfont}%
18 \topmark{\string\topmark:}%
19 \firstmark{\string\firstmark:}%
20 \botmark{\string\botmark:}%
21 \splitfirstmark{\string\splitfirstmark:}%
22 \splitbotmark{\string\splitbotmark:}%
23 #1{\string#1}%
24 \@nil % for the \@car
25 \edef\@tempa{\expandafter\strip@prefix\meaning\@tempb}%
26 \edef\@tempb{\meaning#1}%
27 \ifx\@tempa\@tempb \global\let#2#1%
28 \else
29 \PackageError{mathstyle}%
30 {Unable to properly define \string#2; primitive
31 \noexpand#1no longer primitive}\@eha
32 \fi
33 \fi
34 \endgroup
35 }

```

`\everydisplay` We need to keep track of whether we're in inline or display maths, and the only way to do that is to add a switch inside `\everydisplay`. We act sensibly and preserve any of the previous contents of that token register before adding our own code here.

```
36 \everydisplay=\expandafter{\the\everydisplay\chardef\mathstyle\z@}
```

`\mathstyle` A counter for the math style: 0–display, 1–text, 2–script, 3–scriptscript. The logic is that display maths will explicitly set `\mathstyle` to zero (see above), so by default it is set to the ‘text’ maths style.

```
37 \chardef\mathstyle\@ne
```

Save the four style changing primitives, `\mathchoice` and the fraction commands.

```

38 \@saveprimitive\displaystyle\@@displaystyle
39 \@saveprimitive\textstyle\@@textstyle
40 \@saveprimitive\scriptstyle\@@scriptstyle
41 \@saveprimitive\scriptscriptstyle\@@scriptscriptstyle

```

```

42 \@saveprimitive\mathchoice\@@mathchoice
43 \@saveprimitive\over\@@over
44 \@saveprimitive\atop\@@atop
45 \@saveprimitive\above\@@above
46 \@saveprimitive\overwithdelims\@@overwithdelims
47 \@saveprimitive\atopwithdelims\@@atopwithdelims
48 \@saveprimitive\abovewithdelims\@@abovewithdelims

```

Then we redeclare the four style changing primitives.

```

49 \DeclareRobustCommand{\displaystyle}{%
50   \@@displaystyle \chardef\mathstyle\z@}
51 \DeclareRobustCommand{\textstyle}{%
52   \@@textstyle \chardef\mathstyle\@ne}
53 \DeclareRobustCommand{\scriptstyle}{%
54   \@@scriptstyle \chardef\mathstyle\tw@}
55 \DeclareRobustCommand{\scriptscriptstyle}{%
56   \@@scriptscriptstyle \chardef\mathstyle\thr@@}

```

First we get the primitive operations. These should have been control sequences in T_EX just like operations for begin math, end math, begin display, end display.

```

57 \begingroup \catcode'\^=7\relax \catcode'\_ =8\relax % just in case
58 \lowercase{\endgroup}
59 \let\@@superscript=^ \let\@@subscript=_
60 }%
61 \begingroup \catcode'\^=12\relax \catcode'\_ =12\relax % just in case
62 \lowercase{\endgroup}
63 \let\@@superscript@other=^ \let\@@subscript@other=_
64 }%

```

If we enter a sub- or superscript the `\mathstyle` must be adjusted. Since all is happening in a group, we do not have to worry about resetting.

```

65 \def\subsupstyle{%
66   \ifnum\mathstyle<\tw@ \chardef\mathstyle\tw@
67   \else \chardef\mathstyle\thr@@
68   \fi
69 }

```

Provide commands with meaningful names for the two primitives, cf. `\mathrel`.

```

70 \let\mathsup=\@@superscript
71 \let\mathsub=\@@subscript

```

`\sb` and `\sp` are then defined as macros.

```

72 \def\sb#1{\mathsub{\protect\subsupstyle#1}}%
73 \def\sp#1{\mathsup{\protect\subsupstyle#1}}%

```

`\mathchoice` `\mathchoice` is now just a switch. Note that this redefinition does not allow the arbitrary *filler* of the T_EX primitive. Very rarely used anyway.

```

74 \def\mathchoice{%
75   \relax\ifcase\mathstyle
76     \expandafter\@firstoffour
77   \or

```

```

78   \expandafter\@secondoffour
79   \or
80   \expandafter\@thirdoffour
81   \else
82   \expandafter\@fourthoffour
83   \fi
84 }

```

Helper macros.

```

85 \providecommand\@firstoffour[4]{#1}
86 \providecommand\@secondoffour[4]{#2}
87 \providecommand\@thirdoffour[4]{#3}
88 \providecommand\@fourthoffour[4]{#4}

```

`\genfrac` The fractions. Note that this uses the same names as in `amsmath`. Much the same except here they call `\fracstyle`.

```

89 \DeclareRobustCommand\genfrac[6]{%
90   {#1\fracstyle
91     {\begingroup #5\endgroup
92       \csname @@\ifx\maxdimen#4\maxdimen over\else above\fi
93       \if @#2@\else withdelims\fi\endcsname #2#3#4\relax
94       #6}%
95   }%
96 }

97 \renewcommand{\frac}{\genfrac{}{}{}{}}
98 \providecommand{\dfrac}{}
99 \providecommand{\tfrac}{}
100 \renewcommand{\dfrac}{\genfrac\displaystyle{}{}{}}
101 \renewcommand{\tfrac}{\genfrac\textstyle{}{}{}}
102 \providecommand{\binom}{}
103 \providecommand{\tbinom}{}
104 \providecommand{\dbinom}{}
105 \renewcommand{\binom}{\genfrac{}{}{0pt}}
106 \renewcommand{\dbinom}{\genfrac\displaystyle{}{0pt}}
107 \renewcommand{\tbinom}{\genfrac\textstyle{}{0pt}}

```

The `\fracstyle` command is a switch to go one level down but no further than three.

```

108 \def\fracstyle{\ifcase\mathstyle
109   \chardef\mathstyle=\@ne
110   \or
111   \chardef\mathstyle=\tw@
112   \else
113   \chardef\mathstyle=\thr@@
114   \fi
115 }

```

The `\currentmathstyle` checks the value of `\mathstyle` and switches to it so it is in essence the opposite of `\displaystyle` and friends.

```

116 \def\currentmathstyle{%

```

```

117 \ifcase\mathstyle
118   \@@displaystyle
119 \or
120   \@@textstyle
121 \or
122   \@@scriptstyle
123 \or
124   \@@scriptscriptstyle
125 \fi}

```

Finally, we declare the package options.

```

126 \DeclareOption{mathactivechars}{%
127 % \catcode'\^=12\relax
128 % \catcode'\_ =12\relax
129 \AtBeginDocument{\catcode'\^=12\relax \catcode'\_ =12\relax}%
130 }
131 \DeclareOption{activechars}{%
132 % \catcode'\^=13\relax
133 % \catcode'\_ =13\relax
134 \AtBeginDocument{\catcode'\^=13\relax \catcode'\_ =13\relax}%
135 }
136 \DeclareOption{noactivechars}{%
137 % \catcode'\^=7\relax
138 % \catcode'\_ =8\relax
139 \AtBeginDocument{\catcode'\^=7\relax \catcode'\_ =8\relax}%
140 }
141 \ExecuteOptions{mathactivechars}
142 \ProcessOptions\relax

```

WSPR: Set up the active behaviours: (this is set even in the `noactivechars` case but they are never activated. no worries?)

```

143 \ifnum\catcode'\^=13\relax
144   \let^=\sp \let_=\sb
145 \else
146   \mathcode'\^="8000\relax
147   \mathcode'\_ ="8000\relax
148   \begingroup
149     \catcode'\^=\active
150     \catcode'\_ =\active
151     \global\let^=\sp
152     \global\let_=\sb
153   \endgroup
154 \fi
155 \end{package}

```

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.

Symbols	
<code>\@@above</code>	45
<code>\@@abovewithdelims</code>	48
<code>\@@atop</code>	44
<code>\@@atopwithdelims</code>	47
<code>\@@displaystyle</code>	38, 50, 118
<code>\@@mathchoice</code>	42
<code>\@@over</code>	43
<code>\@@overwithdelims</code>	46
<code>\@@scriptscriptstyle</code>	41, 56, 124
<code>\@@scriptstyle</code>	40, 54, 122
<code>\@@subscript</code>	59, 71
<code>\@@subscript@other</code>	63
<code>\@@superscript</code>	59, 70
<code>\@@superscript@other</code>	63
<code>\@@textstyle</code>	39, 52, 120
<code>\@car</code>	16, 24
<code>\@eha</code>	31
<code>\@firstoffour</code>	76, 85
<code>\@fourthoffour</code>	82, 88
<code>\@one</code>	37, 52, 109
<code>\@nil</code>	24
<code>\@saveprimitive</code>	<u>2</u> , 38–48
<code>\@saveprimitive@a</code>	9, 14
<code>\@secondoffour</code>	78, 86
<code>\@tempa</code>	4, 5, 8, 25, 27
<code>\@tempb</code>	4, 5, 7, 8, 16, 17, 25–27
<code>\@thirdoffour</code>	80, 87
<code>\^</code>	57, 61, 127, 129, 132, 134, 137, 139, 143, 146, 149
<code>_</code>	57, 61, 128, 129, 133, 134, 138, 139, 147, 150
A	
<code>\above</code>	45
<code>\abovewithdelims</code>	48
<code>\active</code>	149, 150
<code>\AtBeginDocument</code>	129, 134, 139
<code>\atop</code>	44
<code>\atopwithdelims</code>	47
B	
<code>\begingroup</code>	3, 15, 57, 61, 91, 148
<code>\binom</code>	102, 105
<code>\botmark</code>	20
C	
<code>\catcode</code>	57, 61, 127–129, 132–134, 137–139, 143, 149, 150
<code>\chardef</code>	36, 37, 50, 52, 54, 56, 66, 67, 109, 111, 113
<code>\csname</code>	92
<code>\currentmathstyle</code>	116
D	
<code>\dbinom</code>	104, 106
<code>\DeclareOption</code>	126, 131, 136
<code>\DeclareRobustCommand</code>	49, 51, 53, 55, 89
<code>\def</code>	16, 65, 72–74, 108, 116
<code>\dfrac</code>	98, 100
<code>\displaystyle</code>	38, 49, 100, 106
E	
<code>\edef</code>	4, 7, 16, 25, 26
<code>\else</code>	6, 9, 28, 67, 81, 92, 93, 112, 145
<code>\endcsname</code>	93
<code>\endgroup</code>	12, 34, 58, 62, 91, 153
<code>\everydisplay</code>	<u>36</u>
<code>\ExecuteOptions</code>	141
<code>\expandafter</code>	25, 36, 76, 78, 80, 82
F	
<code>\fi</code>	10, 11, 32, 33, 68, 83, 92, 93, 114, 125, 154
<code>\firstmark</code>	19
<code>\frac</code>	97
<code>\fracstyle</code>	90, 108
G	
<code>\genfrac</code>	<u>89</u> , 97, 100, 101, 105–107
<code>\global</code>	5, 27, 151, 152
I	
<code>\if</code>	93
<code>\ifcase</code>	75, 108, 117
<code>\ifnum</code>	66, 143
<code>\ifx</code>	5, 8, 27, 92
L	
<code>\let</code>	5, 27, 59, 63, 70, 71, 144, 151, 152

<code>\lowercase</code>	58, 62		
M		R	
<code>\mathchoice</code>	42, 74	<code>\relax</code>	57, 61, 75, 93, 127–129, 132–134, 137–139, 142, 143, 146, 147
<code>\mathcode</code>	146, 147	<code>\renewcommand</code> ..	97, 100, 101, 105–107
<code>\mathstyle</code> ..	36, 37, 50, 52, 54, 56, 66, 67, 75, 108, 109, 111, 113, 117	S	
<code>\mathsub</code>	71, 72	<code>\sb</code>	72, 144, 152
<code>\mathsup</code>	70, 73	<code>\scriptscriptstyle</code>	41, 55
<code>\maxdimen</code>	92	<code>\scriptstyle</code>	40, 53
<code>\meaning</code>	4, 7, 25, 26	<code>\sp</code>	73, 144, 151
N		<code>\splitbotmark</code>	22
<code>\noexpand</code>	31	<code>\splitfirstmark</code>	21
<code>\nullfont</code>	17	<code>\string</code>	4, 18–23, 30
O		<code>\strip@prefix</code>	25
<code>\or</code>	77, 79, 110, 119, 121, 123	<code>\subsupstyle</code>	65, 72, 73
<code>\over</code>	43	T	
<code>\overwithdelims</code>	46	<code>\tbinom</code>	103, 107
P		<code>\textstyle</code>	39, 51, 101, 107
<code>\PackageError</code>	29	<code>\tfrac</code>	99, 101
<code>\ProcessOptions</code>	142	<code>\the</code>	36
<code>\protect</code>	72, 73	<code>\thr@@</code>	56, 67, 113
<code>\providecommand</code>		<code>\topmark</code>	18
.....	2, 14, 85–88, 98, 99, 102–104	<code>\tw@</code>	54, 66, 111
		Z	
		<code>\z@</code>	36, 50