Using the *MathTimeProfessional* Font Supplement A with LaTeX*

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1 Introduction

Font Supplement A for the *MathTimeProfessional* fonts is designed to provide Times-compatible versions of the various operators on the AMS's `msam` and `msbm` fonts and the so-called LaTeX symbols, as well as several different 'blackboard bold' fonts.

The macro package mtpams can be regarded as the counterpart to the packages amssymb and latexsym. While the latter are to be used in conjunction with the Computer Modern math fonts, mtpams provides, roughly speaking, the same functionality for the *MathTimeProfessional* fonts, i.e., making additional math symbols available, and providing a mathematical 'blackboard bold' alphabet.

In contrast to amssymb, however, the package does *not* implement a mathematical fraktur alphabet `\mathfrak`. A fraktur font which blends well with Times is provided in the *MathTimeProfessional* Supplement B collection and can be used through the related macro package mtpb. Alternatively, load the standard package eufrak to use the free 'Euler Fraktur' typeface.

The package mtpams is to be used in conjunction with version 4 of the package mtpro, which should be loaded *first*:

```
\usepackage[⟨options⟩]{mtpro}
\usepackage[⟨options⟩]{mtpams}
```

Otherwise, mtpro gets loaded automatically, and you cannot pass any package options to it.

2 Blackboard Bold

The package mtpams makes a 'blackboard bold' math alphabet available with the name `\mathbb`. Two different varieties of 'blackboard bold' fonts are provided:

*This document refers to version v4.1 of the macro package mtpams, to be used with the updated fonts from Supplement A.

The first version, *MathTime* **h**oley **r**oman **b**old, is a 'bold open' font, formed by hollowing out bold letters:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

By contrast, the *MathTime* **b**lackboard **b**old font is the sort of alphabet that one might actually write on a blackboard:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

Or you might prefer one of the dark versions, **h**oley **r**oman **d**ark:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

or **b**lackboard **b**old **d**ark:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

The font that will actually be used for `\mathbb` is selected through a package option:

mtphrb holey roman bold

mtpbb blackboard bold (default)

mtphrd holey roman dark

mtpbbd blackboard bold dark

3 New symbols

3.1 Ordinary symbols

Most of the new symbols are binary operators or relations, but first we have a group of various ordinary symbols, shown in table 1. `\checkmark`, `\maltese` and `\circledR` are sort of special, since they can be used both in text mode and in math mode.

For technical reasons, the AMS symbols ¥ (`\yen`), $\digamma$ (`\digamma`), and $\hslash$ (`\hslash`), have been placed on the latest versions of the *MathTimeProfessional* basic fonts, along with the $\hbar$ (`\bar`) already appearing there, and their definitions appear in the macro package mtpro from v4.0 on, so you don't need the supplementary fonts to use them.

$\diamondsuit$ (`\Diamond`) appears in the so-called LaTeX symbols, and you may prefer its shape over $\Diamond$.

3.2 Delimiters

Table 2 shows four special delimiters (which occur in only one size).

‵	\backprime	∅	\varnothing
△	\vartriangle	▲	\blacktriangle
▽	\triangledown	▼	\blacktriangledown
□	\square	■	\blacksquare
◊	\lozenge	⧫	\blacklozenge
◇	\Diamond	★	\bigstar
∡	\measuredangle	◁	\sphericalangle
∄	\nexists	∁	\complement
℧	\mho	ð	\eth
ⅎ	\Finv	⅁	\Game
╱	\diagup	╲	\diagdown
ב	\beth	ג	\gimel
ד	\daleth	✓	\checkmark
✠	\maltese	Ⓡ	\circledR
		Ⓢ	\circledS

Table 1: Ordinary symbols.

⌜	\ulcorner	⌝	\urcorner
⌞	\llcorner	⌟	\lrcorner

Table 2: Delimiters

3.3 Binary operators

Table 3 shows the additional binary operator symbols that are made available with the package mtpams. The macro \smallsetminus is actually just a synonym for \setdif on the *MathTimeProfessional* basic fonts.

∔	\dotplus	∖	\smallsetminus
⋉	\ltimes	⋊	\rtimes
⋒	\Cap ,\doublecap	⋓	\Cup,\doublecup
⋋	\leftthreetimes	⋌	\rightthreetimes
⊼	\barwedge	⩒	\veebar
⩎	\doublebarwedge		
⋏	\curlywedge	⋎	\curlyvee
⊞	\boxplus	⊟	\boxminus
⊠	\boxtimes	⊡	\boxdot
⊝	\circleddash	⊛	\circledast
⊚	\circledcirc	⋇	\divideontimes
∙	\centerdot	⊺	\intercal

Table 3: Binary operators

3.4 Binary relations

In table 4, note that $\sqsubset$ (`\sqsubset`) and $\sqsupset$ (`\sqsupset`) are new symbols, while the more complicated $\sqsubseteq$ (`\sqsubseteq`) and $\sqsupseteq$ (`\sqsupseteq`) already exist on the basic fonts!

Note also that $\smile$ (`\smallsmile`) and $\frown$ (`\smallfrown`) are different from the symbols $\cup$ (`\cupprod`) and $\cap$ (`\capprod`), and that the old $\models$ (`\models`) is different from $\vDash$ (`\vDash`).

$\leqq$	`\leqq`	$\geqq$	`\geqq`
$\leqslant$	`\leqslant`	$\geqslant$	`\geqslant`
$\eqslantless$	`\eqslantless`	$\eqslantgtr$	`\eqslantgtr`
$\lesssim$	`\lesssim`	$\gtrsim$	`\gtrsim`
$\lessapprox$	`\lessapprox`	$\gtrapprox$	`\gtrapprox`
$\approxeq$	`\approxeq`		
$\lessdot$	`\lessdot`	$\gtrdot$	`\gtrdot`
$\lll$	`\lll`, `\llless`	$\ggg$	`\ggg`, `\gggtr`
$\lessgtr$	`\lessgtr`	$\gtrless$	`\gtrless`
$\lesseqgtr$	`\lesseqgtr`	$\gtreqless$	`\gtreqless`
$\lesseqqgtr$	`\lesseqqgtr`	$\gtreqqless$	`\gtreqqless`
$\doteqdot$	`\doteqdot`, `\Doteq`	$\eqcirc$	`\eqcirc`
$\fallingdotseq$	`\fallingdotseq`	$\risingdotseq$	`\risingdotseq`
$\circeq$	`\circeq`	$\triangleq$	`\triangleq`
$\backsim$	`\backsim`	$\thicksim$	`\thicksim`
$\backsimeq$	`\backsimeq`	$\thickapprox$	`\thickapprox`
$\subseteqq$	`\subseteqq`	$\supseteqq$	`\supseteqq`
$\Subset$	`\Subset`	$\Supset$	`\Supset`
$\sqsubset$	`\sqsubset`	$\sqsupset$	`\sqsupset`
$\preccurlyeq$	`\preccurlyeq`	$\succcurlyeq$	`\succcurlyeq`
$\curlyeqprec$	`\curlyeqprec`	$\curlyeqsucc$	`\curlyeqsucc`
$\precsim$	`\precsim`	$\succsim$	`\succsim`
$\precapprox$	`\precapprox`	$\succapprox$	`\succapprox`
$\vartriangleleft$	`\vartriangleleft`	$\vartriangleright$	`\vartriangleright`
$\trianglelefteq$	`\trianglelefteq`	$\trianglerighteq$	`\trianglerighteq`
$\blacktriangleleft$	`\blacktriangleleft`	$\blacktriangleright$	`\blacktriangleright`
$\vDash$	`\vDash`	$\Vdash$	`\Vdash`
$\Vvdash$	`\Vvdash`		
$\smallsmile$	`\smallsmile`	$\smallfrown$	`\smallfrown`
$\shortmid$	`\shortmid`	$\shortparallel$	`\shortparallel`
$\bumpeq$	`\bumpeq`	$\Bumpeq$	`\Bumpeq`
$\therefore$	`\therefore`	$\because$	`\because`
$\between$	`\between`	$\pitchfork$	`\pitchfork`
$\varpropto$	`\varpropto`	$\backepsilon$	`\backepsilon`

Table 4: Binary relations

3.5 Negated relations

Negated relation symbols are summarized in table 5. Symbols in brackets already appear on the basic mtpro fonts. (Whereas, with Computer Modern, they are provided only by the extra AMS symbol fonts.) Note that $\nsim$ (`\nsim`) from the font supplement is definitely different from $\not\sim$ (`\notsim`) from the basic fonts.

Symbols that are marked with an asterisk do not exist in the traditional (Computer Modern) AMS fonts.

$\not<$	[\nless]	$\not>$	[\ngtr]
$\not\leq$	[\nleq]	$\not\geq$	[\ngeq]
$\not\leqslant$	\nleqslant	$\not\geqslant$	\ngeqslant
$\not\leqq$	\nleqq	$\not\geqq$	\ngeqq
$\lneq$	\lneq	$\gneq$	\gneq
$\lneqq$	\lneqq	$\gneqq$	\gneqq
$\lvertneqq$	\lvertneqq	$\gvertneqq$	\gvertneqq
$\lnsim$	\lnsim	$\gnsim$	\gnsim
$\lnapprox$	\lnapprox	$\gnapprox$	\gnapprox
$\not\prec$	[\nprec]	$\not\succ$	[\nsucc]
$\not\preceq$	[\npreceq]	$\not\succeq$	[\nsucceq]
$\precneqq$	\precneqq	$\succneqq$	\succneqq
$\precnsim$	\precnsim	$\succnsim$	\succnsim
$\precnapprox$	\precnapprox	$\succnapprox$	\succnapprox
$\not\sim$	\nsim	$\not\cong$	[\ncong]
$\nshortmid$	\nshortmid	$\nshortparallel$	\nshortparallel
$\nmid$	\nmid	$\nparallel$	\nparallel
$\nvdash$	\nvdash	$\nvDash$	\nvDash
$\nVdash$	\nVdash	$\nVDash$	\nVDash
$\not\triangleleft$	\ntriangleleft	$\not\triangleright$	\ntriangleright
$\not\subseteq$	[\nsubseteq]	$\not\supseteq$	[\nsupseteq]
$\not\subseteqq$	\nsubseteqq	$\not\supseteqq$	\nsupseteqq
$\subsetneq$	\subsetneq	$\supsetneq$	\supsetneq
$\varsubsetneq$	\varsubsetneq	$\varsupsetneq$	\varsupsetneq
$\subsetneqq$	\subsetneqq	$\supsetneqq$	\supsetneqq
$\varsubsetneqq$	\varsubsetneqq	$\varsupsetneqq$	\varsupsetneqq
$\not\sqsubset$	\nsqsubset*	$\not\sqsupset$	\nsqsupset*
$\not\sqsubseteq$	[\nsqsubseteq]*	$\not\sqsupseteq$	[\nsqsupseteq]*

Table 5: Negated relations. Symbols in square brackets are provided already by the basic *MathTimeProfessional* fonts. Symbols marked by an asterisk do not exist on the Computer Modern AMS fonts.

3.6 Arrows

The arrows from table 6 are of type `\mathrel`. It should be noted that $\rightleftharpoons$ (`\rightleftharpoons`) is already provided by the *MathTimeProfessional* basic

fonts. The arrow $\leadsto$ (`\leadsto`) appears in the 'LaTeX symbols', and its shape is more common than $\rightsquigarrow$ from the AMS fonts. A number of arrows are also provided in negated form, see table 7.

`\rarrowhead`, `\larrowhead`, and `\midshaft` (which are not given names in the AMS fonts) can be used to construct longer dashed arrows. For example

```
\mathrel{\midshaft\midshaft\midshaft\rarrowhead}
```

can be used to produce the arrow in the formula

$$A \mathrel{\midshaft\midshaft\midshaft\rarrowhead} B.$$

$\dashrightarrow$	`\dashrightarrow`, `\dasharrow`	$\dashleftarrow$	`\dashleftarrow`
$\larrowhead$	`\larrowhead`*	$\rarrowhead$	`\rarrowhead`*
$\midshaft$	`\midshaft`*		
$\leftleftarrows$	`\leftleftarrows`	$\rightrightarrows$	`\rightrightarrows`
$\leftrightarrows$	`\leftrightarrows`	$\rightleftarrows$	`\rightleftarrows`
$\Lleftarrow$	`\Lleftarrow`	$\Rrightarrow$	`\Rrightarrow`
$\twoheadleftarrow$	`\twoheadleftarrow`	$\twoheadrightarrow$	`\twoheadrightarrow`
$\leftarrowtail$	`\leftarrowtail`	$\rightarrowtail$	`\rightarrowtail`
$\looparrowleft$	`\looparrowleft`	$\looparrowright$	`\looparrowright`
$\leftrightharpoons$	`\leftrightharpoons`	$\rightleftharpoons$	[`\rightleftharpoons`]
$\curvearrowleft$	`\curvearrowleft`	$\curvearrowright$	`\curvearrowright`
$\circlearrowleft$	`\circlearrowleft`	$\circlearrowright$	`\circlearrowright`
$\Lsh$	`\Lsh`	$\Rsh$	`\Rsh`
$\upuparrows$	`\upuparrows`	$\downdownarrows$	`\downdownarrows`
$\upharpoonright$	`\upharpoonright`, `\restriction`	$\upharpoonleft$	`\upharpoonleft`
$\downharpoonright$	`\downharpoonright`	$\downharpoonleft$	`\downharpoonleft`
$\rightsquigarrow$	`\rightsquigarrow`	$\leadsto$	`\leadsto`
$\leftrightsquigarrow$	`\leftrightsquigarrow`	$\multimap$	`\multimap`

Table 6: Arrows. The symbol `\rightleftharpoons` is provided already by the basic *MathTimeProfessional* fonts. Symbols marked by an asterisk do not exist on the Computer Modern fonts.

$\nleftarrow$	`\nleftarrow`	$\nrightarrow$	`\nrightarrow`
$\nLeftarrow$	`\nLeftarrow`	$\nRightarrow$	`\nRightarrow`
$\nleftrightarrow$	`\nleftrightarrow`	$\nLeftrightarrow$	`\nLeftrightarrow`

Table 7: Arrows (negated)

3.7 Alternative symbol names

Several symbols are made available both under the names known introduced by the AMS and under the names known from LaTeX 2.09 or from the latexsym package; see table 8.

	AMS:	latexsym:
$\square$	`\square`	`\Box`
$\lhd$	`\vartriangleleft`	`\lhd`
$\trianglelefteq$	`\trianglelefteq`	`\unlhd`
$\rhd$	`\vartriangleright`	`\rhd`
$\trianglerighteq$	`\trianglerighteq`	`\unrhd`
$\bowtie$	`\bowtie`	`\Join`

Table 8: Alternative names for symbols

4 Bold and heavy type

Bold and 'heavy' (extra-bold) versions of the new symbols are accessible via the declaration `\boldmath` and through the commands `\bm` and `\hm` of the package bm. To recognize the existence of heavy symbols, the package bm must be loaded *after* mtpams.

`\boldmath` and `\bm` also act on the 'blackboard bold' and 'holey roman bold' fonts and yield the related 'dark' font. However, if you have already chosen one of the 'dark' fonts for the `\mathbb` alphabet (option mtpbbd or mtphrd), it will not be emboldened further.