New TX font package

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1   Introduction

This package is meant to be a replacement for Young Ryu's `txfonts`. It is a complete text (`newtxtext`) and math (`newtxmath`) package with roman text font provided by a Times clone, sans serif based on a Helvetica clone, typewriter faces, plus math symbol fonts whose math italic letters are from a Times Italic clone. As of version 1.4, `newtxtext` no longer depends on `txfonts` but is based on the richer source TeXGyre Termes, but `newtxmath` continues to use the `txfonts` math glyphs with many metric adjustments and some wholesale modifications.

This math package works, after possibly replacing its math Roman and Greek letters, with fonts other than Times that are intermediate in weight between Computer Modern and Times. The free font Linux Libertine is one particular target—it is of nearly the same x-height as Computer Modern, but, not being a *modern* font, does not have a high contrast ratio, and so appears denser than Computer Modern but not as much so as Times. It is meant as a replacement for Times, but differs from it in many characteristics, more similar to MinionPro than Times, and provides a better range of variants than Times—three weights (regular, semi-bold and bold) rather than just two, and has expert features in all weights: old-style figures, more extensive and more interesting ligatures, and small caps. In my opinion, material typeset in Linux Libertine looks better than the corresponding material typeset in Times. This seems especially true on the screen. As of version 1.0, the package also offers support for MinionPro as a math font, but with limitations described in detail below. More recently, an option to provide math support for the garamondx text font package was added.

The `newtx` package differs from `txfonts` in the following ways:

- the new package is split into separate text and math packages that do not need to be used in conjunction;

- both text and math packages offer options not present in the original package, described below, including the option to use libertine Latin and Greek letters to replace Times, as well as a similar option minion;

- wide accent glyphs have been corrected (they should have zero depth) so that they no longer collide with the underlying glyph;

- for those who do not like the integral in txfonts, an emboldened version of the Computer Modern integral is made available, matching the weight of the txfonts symbols;

- an upright partial derivative symbol has been added, named `\uppartial`;

- there is now an option to get braces more pleasing to older eyes;

- macros have been added to bring the calls to Greek symbols more into conformity with PSNFSS and Mathtime Pro 2;

- problems using AMS macro packages before txfonts are settled;

- `\coloneq` and `\eqcolon` now point to the correct glyphs;

- The problem with the ogonek accent and tabular environments (bad definition of `\k`) is fixed;

- The default encoding for newtxtext is now T1, but support is offered also for OT1 and LY1. As some add-on packages are available only in T1, that seems the best current choice.

- Sans serif is by default taken from TeXGyreHeros, and by default at 90% of the scale factor (set by `scaled`, default value 1). The option `helvratio=.98` will change that to 98%.

- `\varkappa` $\varkappa$ has been moved from AMSb to `lettersA`, and is now accompanied by an upright form `\upvarkappa` $\varkappa$ which behaves as it should when using the `frenchmath` option.

2   Text mode options

Beginning with version 1.4, the text font component of newtx is no longer dependent on the `txfonts`, and is constructed entirely from TeXGyre Termes and some modifications thereof.

The text mode environment invoked by

`\usepackage{newtxtext}`

has several options, a number new to version 1.4: you may write

`\usepackage[scaled=.93]{newtxtext}`

to load the roman and typewriter text fonts at 93% of normal size, and the sans serif (Helvetica clone) at scale $0.9 * 0.93$. This is not of much utility if the package is used with the math package newtxmath to which it is already matched, but may be with other math packages. The options

`\usepackage[scaled=.95,helvratio=.96]{newtxtext}`

load roman and typewriter text fonts at 95% of normal size, and the sans serif (Helvetica clone) at scale $0.95 * 0.96$.

The option `osf` instructs the text fonts to use old-style figures 1234567890 rather than the default lining figures 1234567890. As of version 1.23, newtxtext loads initially with lining figures so the math package uses lining figures in math mode. The option `osf` switches to old-style figures in text at the very end of the preamble, forcing the use of oldstyle figures in text, but not math. In previous versions, it was necessary to run `\useosf` after loading math. This is no longer required, but does no harm.

There is one special case where `\useosf` is necessary: in you use the babel package, you should load it before newtxtext—for example:

```
\usepackage[<babel options>]{babel}
\usepackage[osf]{newtxtext}
% works as expected if no math package loaded
```

If you want to use `babel` and a math package, you have to be aware of an incompatibility between some `babel` code and the `etoolbox` command `\AtEndPreamble`. In this case, use instead the more cumbersome form:

```
\usepackage[<babel options>]{babel}
\usepackage{newtxtext}
<other babel font loading commands>
\usepackage{newtxmath}
\useosf % must be after loading math package
```

As of version 1.4, there are four normal figure styles: tabular lining, tabular oldstyle, proportional lining and proportional oldstyle, the default figure alignment being `tabular`. To switch to `proportional`, use the option `p` or `proportional`.

Option `defaultsups` (same effect as `defaultsups=true`) forces the package to use the LaTeX default footnote markers (or, at least, those in force when the package is loaded) instead of those preferred by the package—Times Roman superior figures instead of spindly ordinary Times lining figures reduced to about 70%. (Footnote markers in minipages use the default lowercase italic alphabetic characters, unless otherwise specified by redefining `\thempfootnote`.) For better control over position and size of footnote markers, use the `superiors` package after loading `newtxtext`. The `\sustyle` font switch and its related `\textsu` macro know not only about figures, but also the lower case letters, including `egrave`, so that traditional French expressions like 1$^{\text{ière}}$ may be typeset correctly.

Option `largesc` changes the small cap glyphs from the default petite caps defined in TeXGyre Termes (same size as in txfonts) to a larger size that, in upright shapes, is metrically compatible with Adobe's small caps. These are about 10% larger than petite caps. For a comparison, SMALL CAPS, PETITE CAPS, and *ITALIC SMALL CAPS*, *ITALIC PETITE CAPS*.

Option `adobesc` is only for those who own licenses for Adobe Times Small Caps and install them into the `ptmsc` package downloaded from CTAN. This option loads `largesc` and substitutes the Adobe glyphs, where available, including their larger Regular and Bold tabular oldstyle figures.

The `theoremfont` option changes the default font used for the `plain` theoremstyle of `amsthm`, keeping italic text but substituting upright figures and punctuation, and, provided you have loaded `theorem` or `amsthm` before `newtxtext`, it will redefine the plain theoremstyle. For example, with this option, you get theorem statements like this:

Theorem 2.1. *This is Theorem Italic*: *text numbers are upright*—12345; *punctuation is in many cases upright* (*also, parens, braces* {} *and brackets* []). *What about question marks and exclamations*? *Also upright*! [*These fit better with math mode punctuation and figures, like*: *for all* $x \in [0, 1]$, *let* $f(x) := \exp(\alpha x)$].

Compare this to traditional `plain` theoremstyle with the same text:

Theorem 2.1. *This is Theorem Italic: text numbers are upright—12345; punctuation is in many cases upright (also, parens, braces {} and brackets []). What about question marks and exclamations? Also upright! [These fit better with math mode punctuation and figures, like: for all $x \in [0, 1]$, let $f(x) := \exp(\alpha x)$].*

3   Math mode options

The package invoked by

```
\usepackage{newtxmath}
```

loads the math part of the `txfonts` (with revised metrics and additional glyphs) and should be loaded *after* the text font and its encoding have been specified, as it uses the text font settings to define how operators, numbers, math accents, `\mathrm`, `\mathbf` etc. are rendered. You should also load a Typewriter font so as not to generate mysterious error messages about metafont trying to generate `ectt10`. The package offers a number of options.

- `varg` causes the math italic letters g, v, w, y to be replaced by versions which are more distinctive—eg, useful for distinguishing math italic v from `\nu`;

- `libertine` loads different versions of math italic and bold math italic based on Libertine rather than Times—the `varg` option is disabled in this case, as the equivalent variant forms are made available by default;

- `minion` loads different versions of math italic and bold math italic based on MinionPro rather than Times—the `varg` option is disabled in this case, as the equivalent variant forms are made available by default—see the extended discussion below;

- `garamondx` loads different versions of math italic and bold math italic based on garamondx rather than Times—the `varg` option is disabled in this case, as the equivalent variant forms are made available by default.

- `baskervaldx` (or `Baskervaldx`) loads different versions of math italic and bold math italic based on Baskervaldx rather than Times—the `varg` option is disabled in this case, as the equivalent variant forms are made available by default.

- `utopia` (or `heuristica` or `erewhon`) loads different versions of math italic and bold math italic based on Utopia rather than Times—the `varg` option is disabled in this case, as the equivalent variant forms are made available by default. The Heuristica or Erewhon font package must be installed to use this option. (Erewhon is based on Heuristica, but is 6% smaller and has more complete figures styles and small cap style, as well as a variety of smaller figures—superior, inferior, numerator, denominator.) For example:

  ```
  \usepackage[osf]{erewhon} %extension of Utopia
  \usepackage[varqu,varl]{inconsolata} % sans typewriter
  \usepackage[scaled=.95]{cabin} % sans serif
  \usepackage[utopia,bigdelims,vvarbb]{newtxmath}
  ```

- the `libertine` option also replaces both slanted and upright Greek symbols by the corresponding Libertine glyphs, and similarly for `minion` and `garamondx`;

- `cmintegrals` instructs newtxmath to load a thicker version of the Computer Modern integral in place of the newtxmath default—the txfonts integral (identical to the integral in the Wolfram fonts), which is not to everyone's taste—a consequence is that none of the special forms of txfonts integrals are available;

- the combination

  ```
  \usepackage{amsmath}% loads amstext, amsbsy, amsopn but not amssymb
  \usepackage{newtxmath}
  ```

  causes no error, unlike the same combination with `txfonts`, but does nothing significant. (Recall that amsmath is loaded automatically if you use an AMS document class such as amsart or amsbook, as is amsthm.) The integrals are as defined in `txfonts`. On the other hand,

```
\usepackage{amsmath}
\usepackage[cmintegrals]{newtxmath}
```

allows you to use the forms \iint, \iiint, \iiiint and \idotsint defined in amsmath, but using the pumped-up Computer Modern integral loaded by newtxmath.

- uprightGreek and slantedGreek determine the form of Greek alphabet loaded—the default is uprightGreek, which loads upright uppercase and slanted lowercase Greek symbols, as is customary in Anglo-American mathematical typesetting. With the option slantedGreek, which you might want to use if you cared about ISO standards, all Greek symbols are slanted. No matter which is set, \Gammaup (or \upGamma) gives you upright \Gamma, etc.

- Option frenchmath sets the default style in math mode for rendering uppercase Roman and Greek letters to upright, and lowercase Greek letters to upright. (Introduced in v. 1.28.)

- The option cmbraces instructs newtxmath to ignore the brace collections from txfonts, substituting a collection based on thickened versions of the Computer Modern braces, which I find much easier to distinguish from other delimiters. This works quite well in regular weight but looks a bit clunky in bold. I now prefer the option bigdelims, which supersedes cmbraces.

- The newtxmath package contains three different Blackboard Bold alphabets, where original txfonts contained two. The default, triggered by \mathbb{}, takes its glyphs from the font which replaces msbm and has the same overall appearance of a hollowed-out text font, which I find neither bold nor blackboard-like. The second option, taken from txfonts, is triggered by \varmathbb{}, is more geometric and, in my opinion, preferable but not optimal. The option varbb makes \mathbb{} synonymous with \varmathbb{}. The third option is the double-struck glyphs from the STIX collection. See the expanded discussion below.

- nosymbolsc causes the package to not load the symbolsC fonts, saving a math family. (This font contains mostly exotic symbols, along with some very useful, commonly used symbols like \coloneq ≔, \eqcolon =:, \notin ∉, \notni ∌, \neq ≠, \nsubset ⊄ and \nsupset ⊅, but these have been moved (virtually) to lettersA so they may continue to be used even if you use the option nosymbolsc.)

- amssymbols (the default) and noamssymbols determine whether the txfonts versions of the AMS symbols (msam, msbm) are loaded—if so, they override previous settings in amsmath. If you use the option noamssymbols, then \mathbb{} is set to mean the same as \varmathbb{}. (One advantage of noamssymbols is that you save two of your precious math families for other purposes, such as setting a couple of external math alphabets by means of the mathalfa package.)

- libaltvw has effect only if the libertine option is selected—in this case, it substitutes for math italic v and w hand-crafted versions based on the Libertine upsilon glyphs.

- bigdelims loads a different math extension font and redefines most of the small and big math delimiters to have larger sizes so that, for example, there is more of a distinction between (and \big(in math mode. If this option is specified, cmbraces is ignored.

- liby has an effect only if the libertine option is selected—with this option, the math italic y is chosen to be Libertine's italic y instead of the default one from txfonts.

- As of version 1.18 of newtxmath (and version 1.07 of newpxmath) there are new math accents and macros available.

  - \widehat and \widetilde have been extended from 3 to 6 sizes, and the smallest is now not as wide as in previous versions. In particular, you can now use, eg, $\widehat{X}^2$, which gives

$\widehat{X}^2$ without the hat colliding with the superscript.

– The math double bracket delimiters have been moved to another family so their use is less likely to cause a "too many math families" error. The ordinary sizes now have their own macros, \dlb and \drb, giving, eg, $[\![0, T]\!]$, as commonly used in probability theory.

– The new macros \overgroup, \undergroup, \overgroupra, \overgroupla, \undergroupra and \undergroupla are intended as replacements for the \wideparen and related macros from the yhmath and fourier packages. In fact, \overgroup and \undergroup are variants of the existing macros \overbrace and \underbrace, while the suffixes ra and la signify right arrow and left arrow respectively. The macro \widering places a ring centered over an \overgroup, not dissimilar from its use in yhmath. Example:

\[\overgroup{ABC}\quad\overgroupra{ABC}\quad\undergroup{ABC}\quad
\undergroupla{ABC}\quad \widering{ABCD}\]

gives

$$\overgroup{ABC} \quad \overrightarrow{ABC} \quad \undergroup{ABC} \quad \underleftarrow{ABC} \quad \overset{\circ}{\overgroup{ABCD}}$$

• As of version 1.23, the package contains new math accents \widearc and \wideOarc similar in effect to those from fourier and kpfonts. Example:

\[\widearc{BC}\quad\widearc{ABC}\quad\widearc{ABCD}\quad
\wideOarc{BC}\quad\wideOarc{ABC}\quad\wideOarc{ABCD}\]

gives

$$\widearc{BC} \quad \widearc{ABC} \quad \widearc{ABCD} \quad \wideOarc{BC} \quad \wideOarc{ABC} \quad \wideOarc{ABCD}$$

• The option timesmathacc changes the default selection of math accents from the Roman text font, forcing the use of the heavier Times accents. (Libertine has much lighter accents which can seem to almost disappear under some conditions.) If your language uses accented operator names, do not use this option.

IMPORTANT: The Libertine text package is now once again named libertine, but requires arguments that are different from the original libertine package.

EXAMPLE 1:

```
\usepackage[osf]{newtxtext} % T1, lining figures in math, osf in text
\usepackage{textcomp} % required for special glyphs
\usepackage{amsmath}
\usepackage[varg,cmintegrals,bigdelims]{newtxmath}
\usepackage{bm} % load after all math to give access to bold math
%\useosf %no longer required if osf specified
```

EXAMPLE 2:

```
\usepackage[lining,semibold]{libertine} % a bit lighter than Times--no osf in math
\usepackage[T1]{fontenc} % best for Western European languages
\usepackage{textcomp} % required to get special symbols
\usepackage[varqu,varl]{inconsolata}% a typewriter font must be defined
\usepackage{amsmath,amsthm}
```

```
\usepackage[libertine,cmintegrals,bigdelims,vvarbb]{newtxmath}
\usepackage[scr=rsfso]{mathalfa}
\usepackage{bm}% load after all math to give access to bold math
%After loading math package, switch to osf in text.
\useosf % for osf in normal text
```

Caution: In encodings T1 and LY1, the macro \mathrm does not produce what you might expect for Greek letters, due to the difference between those encodings and OT1. But what were you expecting with \mathrm{Gamma} anyway? In T1 and LY1, you'll get a math accent.

4 Usage with LuaLATEX and XeLATEX

As far as I can tell, newtxmath works with both, but requires a very specific loading order and choice of options. Briefly, except for libertine text, the math options must all be loaded prior to loading and using fontspec. Be aware that some text packages (eg, cabin) may contain a line like

```
\RequirePackage{fontspec}
```

which would prevent ("option clash" error) a subsequent

```
\usepackage[no-math]{fontspec}
```

unless suppressed by an appropriate option. Eg,

```
\usepackage[type1]{cabin}
```

prevents the problem with the cabin package.

The following examples illustrate some general models, the most unintuitive being the first because it loads a small version, minlibertine, of libertine text for use in math mode as numbers, basic symbols and operators.

EXAMPLE 3:

```
%load text components other than libertine text to be used in math
\usepackage[T1]{fontenc}
\usepackage[scaled=.85]{beramono}% used only by \mathtt
\usepackage[type1]{cabin}% used only by \mathsf
\usepackage{amsmath,amsthm}
\usepackage[libertine,bigdelims]{newtxmath}
% loads minlibertine because no other Roman text package was specified
% so that \mathrm and \mathbf also use minlibertine
\usepackage[scr=rsfso]{mathalfa}
\usepackage{bm}% load after all math to give access to bold math
%Now load the otf text fonts using fontspec---won't affect math
\usepackage[no-math]{fontspec} % process with XeLaTeX or LuaLaTeX
\usepackage{libertine}
%\usepackage[osf,semibold]{libertine} for osf in text, semibold as bold
```

The next example is similar, but in math mode, numbers, basic symbols, operator names, \mathrm and \mathbf will render with fbb-LF, though math italic and math Greek letters will be from libertine. (Note that one specifies the encoding and redefines \rmdefault. For reasons I don't yet understand, it may not

work to load the font package—ie, don't substitute \usepackage{fbb}, as that will mess up bold in the libertine text package.)

EXAMPLE 4:

```
%load text components other than libertine text to be used in math
\usepackage[T1]{fontenc}
\renewcommand{\rmdefault}{fbb-LF}% Roman font for use in math mode
\usepackage[scaled=.85]{beramono}% used only by \mathtt
\usepackage[type1]{cabin}% used only by \mathsf
\usepackage{amsmath,amsthm}
\usepackage[libertine,cmintegrals,bigdelims,vvarbb]{newtxmath}
% does not load minlibertine because another Roman text package was specified
\usepackage[scr=rsfso]{mathalfa}
\usepackage{bm}% load after all math to give access to bold math
%Now load the otf text fonts using fontspec---won't affect math
\usepackage[no-math]{fontspec} % process with XeLaTeX or LuaLaTeX
\usepackage{libertine}
```

5 Alternate forms of glyphs

Several math glyphs have alternate forms:

Command	Result	Alternate Commands	Alternate Forms
\emptyset	∅	\varnothing, \emptysetAlt	∅, ∅
\forall	∀	\forallAlt	∀
\exists	∃	\existsAlt	∃
\nexists	∄	\nexistsAlt	∄

You should be aware that using \varnothing requires loading AMSb.
To use an alternate form throughout your document without changing all occurrences of the usual command, insert something like the following in your preamble after loading newtxmath:

```
\let\forall\forallAlt
```

6 Conformity with amsmath

The newtxmath package now contains a \RequirePackage{amsmath}, as it uses a number of the macros defined there. To pass options to amsmath, you can pass the options as options to \documentclass. For example,

```
\documentclass[11pt,intlimits]{article}
\usepackage{newtxtext}
\usepackage[bigdelims]{newtxmath}
```

will load amsmath with option intlimits. As of version 1.14, newtxmath respects the amsmath macros for placement of limits on integrals.

7 The `minion` option

This option allows the use of MinionPro as math letters (Latin and Greek) within the math font, but there are some caveats:

- you must use a recent version of MinionPro, such as the version that comes with recent versions of Adobe Reader. In addition, the fonts must installed under special names so they can be recognized by the support files—this is spelled out in the documentation for the minion2newtx package that must be downloaded from `CTAN.tug.org` and installed separately.

8 The TeX math font problem

Math font packages in LaTeX are susceptible to the "Too many math alphabets" error, due to exceeding the limit of just sixteen math font families, or mathgroups, as they are called in LaTeX. Put in oversimplified terms that do however correctly represent how this all works in `newtxmath`, the following math fonts are always loaded and permanently (if you didn't prevent loading of some features) occupying slots immediately following `\begin{document}`, and others that may be called for in typesetting a mathematical expression can add to the list as the document grows.

ALWAYS LOADED:

```
0: operators
1: letters
2: symbols
3: largesymbols
4: AMSa
5: AMSb
6: lettersA
7: symbolsC
8: largesymbolsTXA
9: boldoperators
10: boldletters
11: boldsymbols
12: boldlargesymbols
```

NOTES:

- The `operators` font is essentially the Roman text font, used for names of operators and as the target for `\mathrm`—its bold version is used as the target for `\mathbf`;

- if you typeset an expression that, say, calls for a single bold glyph from `symbolsC`, that costs you an entire new slot, leaving only two remaining;

- same with, eg, `\mathit`;

- same with an external Fraktur, Blackboard Bold or Script glyphs;

- if you run out of math alphabets, look first to dropping `AMSa` and `AMSb`, as well as `symbolsC`, which can save you three slots;

- if space is tight, do not call bold versions of the fonts listed above where the bold version is not already loaded, to avoid loading a new mathgroup;

- if you absolutely need a letter (not a math symbol) from some math font that would normally cost you another mathgroup, you might consider using as if it were text, with something like

  `\mbox{{\usefont{U}{ntxmia}{b}{n} X}}`

  which allows you to use letter X from `boldlettersA` but without any math features;

- there is a macro `\ShowMathFonts` in `newtxmath` which may be called at any point in your document, which will provide you a list of the mathgroups currently in use. This can be helpful in figuring out where problems occur. The output lines take the form

  `(<fam number>: <internal font id> = <tfm name> [newtx name])`

9 Bold math fonts

Every math font in the `txfonts` package, and in the `newtx` package, is accompanied by a bold version. Some usage examples are given below. Generally, one may use either `\boldmath` to change an entire formula to bold, or `\boldsymbol` to change one symbol, but the spacing generally works better after loading the `bm` package and using the `\bm` macro.

The text glyphs dotlessi (`\i`) and dotlessj (`\j`) are rarely needed in actual text—in many fonts, roman dotlessi is very similar to the numeral 1. They are however sometimes needed to build special math glyphs. The following table shows how to generate the mathematical forms of dotlessi and dotlessj. I illustrate with only dotlessi—dotlessj is entirely analogous.

Type	Weight	Command	Result
Math Italic	Regular	`$\hat{\imath}$`	$\hat{\imath}$
Math Italic	Bold	`$\bm{\hat{\imath}}$`	$\boldsymbol{\hat{\imath}}$
Roman	Regular	`$\hat{\textrm{\i}}$`	$\hat{\text{\i}}$
Roman	Bold	`$\bm{\hat{\textbf{\i}}}$`	$\hat{\mathbf{\i}}$

In math, bold roman characters are often used to indicate vector quantities, and for this one uses constructions like

- `$\mathbf{x}$` produces **x**;

- `$\bm{\mathrm{x}}$` produces **x** (same as previous but may offer improved spacing);

- `$\bm{x}$` produces $\boldsymbol{x}$ (not roman);

- `$\bm{\hat{\mathbf{x}}}$` produces $\hat{\mathbf{x}}$ (with a bold accent);

- `$\bm{\dot{x}}$` produces $\boldsymbol{\dot{x}}$ (bold but not roman);

- the macro definition

  ```
  \newcommand{\xyvec}[2]{%
  \ensuremath{#1\mkern1.5mu\bm{\textbf{\i}}#2\mkern1.5mu\bm{\textbf{\j}}}}
  ```

  allows you to write `\xyvec{x}{+y}` to output $x\mathbf{i} + y\mathbf{j}$;

- `$\bm{\Gamma}$` produces $\boldsymbol{\Gamma}$ (bold Gamma);

- $\bm{\hat{\Gamma}}$ produces $\hat{\boldsymbol{\Gamma}}$ (bold Gamma with bold accent).

(The last two assume that you have effectively set the option `uprightGreek`—the default.)

10   Blackboard bold

As mentioned briefly above, the package now has a new blackboard bold alphabet built-in, and some new macros to call the non-default versions. To summarize, the problems are:

- the default, called by `\mathbb` is quite ugly and indistinct, but does cooperate with the bolding macros `\bm` and `\boldsymbol`;

- the original variant form called with the macro `\varmathbb` is better, but the macro conflicts with `\bm`. (In fact, the bold version is identical to the regular version, but it is still not right that it conflicts with them.) The problem stems from the part of the definition of `\varmathbb` which allows you to insert an argument with more than one character, like `\varmathbb{ABC}`. Another problem with `\varmathbb` is that it conflicts with `hyperref`—if you use the macro in a moveable argument such as a section heading, you will provoke a LaTeX error message. The solution is to use macros that take a single character as argument, like `\vmathbb{A}` and `\vvmathbb{A}`, which both cooperate with `\bm` and `hyperref`.

- the third, new, alphabet is borrowed from the STIX fonts—it is sharp and quite clear, geometric in design. The only slight problem is that it lacks a full bold version, with only the letters C, D, H, N, P, Q, R, Z, d, e, i and j available. The macro `\vvmathbb` provided to access this alphabet allows only a single character for its argument. The new option `vvarbb` effectively makes `\mathbb` mean the same as `\vvmathbb`. (The reason for including these in the newtx package rather than calling them from the mathalfa package is that newtx leaves very little space for new math symbol fonts and math alphabets, and this way requires no additional such resources.

One interesting feature of the new alphabet is that it contains blackboard bold numbers, of which 0 and 1 will likely be the most useful, perhaps as operator names. I find $\mathbb{1}$=$\vvmathbb{1}$ useful in specifying an indicator, AKA characteristic function. Here are some examples:

	Regular	Bold	Remarks
Default	$\mathbb{R}$ $\mathbb{R}$	$\bm{\mathbb{R}}$ $\mathbb{R}$	
Variant 1	$\varmathbb{R}$ $\mathbb{R}$		Bold is same as regular
... or	$\vmathbb{R}$ $\mathbb{R}$		Single char. argument
Variant 2	$\vvmathbb{R}}$ $\mathbb{R}$	{\boldmath $\vvmathbb{R}$} $\mathbb{R}$	Make a macro for this!

11   Samples from free Times and Libertine packages

TXFONTS:

\usepackage{txfonts}

A formula from the LaTeX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1}(1-t)^{n-k}t^{k-1}u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2}\, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} \mathrm{e}^{-t^2/2}\, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Complete match between text and math size and weight;
- first formula much too cramped;
- upper limit of integral much too close to integral sign;
- square on t in integrand comes very close to colliding with it;
- square root in denominator aligned too far right.

NEWTXFONTS:

```
\usepackage{newtxtext}
\usepackage{newtxmath}
```

A formula from the LaTeX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1}(1-t)^{n-k}t^{k-1}u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2}\, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} \mathrm{e}^{-t^2/2}\, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Complete match between text and math size and weight;
- first formula much less cramped;
- upper limit of integral not too close to integral sign;
- square not too close to t in exponent;
- better alignment of square root in denominator.

MATHTIMEPRO2:

```
\usepackage{newtxtext}
\usepackage[lite]{mtpro2}
```

A formula from the LaTeX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1} (1-t)^{n-k} t^{k-1} u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Complete match between text and math size and weight;

- first formula quite spread out;

- upper limit of integral not too close to integral sign;

- plenty of space between square and t in exponent.

LIBERTINE AND MATHTIMEPRO2:

```
\usepackage{libertine}
\usepackage[T1]{fontenc}
\usepackage[lite]{mtpro2}
```

A formula from the LaTeX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1} (1-t)^{n-k} t^{k-1} u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Mismatch of weight between text and math;

- first formula quite spread out;

- upper limit of integral not too close to integral sign;

- plenty of space between square and t in exponent.

LIBERTINE AND NEWTXMATH:

```
\usepackage{libertine}
\usepackage[T1]{fontenc}
\usepackage[libertine]{newtxmath}
```

A formula from the LATEX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1} (1-t)^{n-k} t^{k-1} u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Very good match between text and math in size and weight;

- first formula not cramped;

- upper limit of integral not too close to integral sign;

- space between square and t in exponent;

- better alignment of square root in denominator.

MATHPTMX:

```
\usepackage{mathptmx}
```

A formula from the LaTeX Companion, 2nd Edition, p.390:

$$t[u_1, \ldots, u_n] = \sum_{k=1}^{n} \binom{n-1}{k-1} (1-t)^{n-k} t^{k-1} u_k.$$

The ISO would prefer that a formula like

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt$$

be typeset instead as

$$\Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} \mathrm{e}^{-t^2/2} \, \mathrm{d}t,$$

with upright π, e and d. I dislike the look of dt when the slope of t is too great.

- Good match between text and math size and weight, though the summation symbol (from the system symbol font) is too small and too dark;

- first formula well spread;

- upper limit of integral not too close to integral sign;

- space between square and t in exponent;

- there are no upright Greek lowercase letters in this package;

- good alignment of square root in denominator;

- infinity symbol not sufficiently large?

- the package lacks a number of amenities that are present in other packages.

12 Items installed

As well as a collection of PostScript fonts, virtual fonts, font definition files and the central `newtxtext.sty` and `newtxmath.sty` files, the package contains one map file `newtx.map` that must be enabled for the package to function correctly. Its name was changed from `ntx.map` to mirror the package name.) The file `implementation.pdf` in this distribution provides a manifest of all files installed together with a brief indication of the sources. (This file is somewhat outdated. The file `mathnotes.pdf` adds details about the sources for the math fonts, though it is rather cursory.)

The font files `ntxexmods.pfb` and `ntxbexmods.pfb` were derived from `cmex10.pfb` by FontForgery, thickening the Computer Modern braces to match the weight of the txfonts braces. The pair `ntxexb.pfb` and `ntxbexb.pfb` were similarly derived from `cmsy7.pfb` and `cmex10.pfb` to produce more braces and matching integral signs based on Computer Modern. The `.tfm` files `rtx[b]mio.tfm` are simply unslanted versions of `rtxmi`, from which we construct upright partial derivative symbols. The last two entries provide us with a way to access custom-encoded versions of `fxlri.pfb` and `fxlbi.map` in order to access some of the unencoded alternate characters—eg, Greek letters, `J.alt` and `v.alt`. The font file LibertineTheta-Regular.pfb was created from the Theta symbol in `fxlri.pfb`, which requires some FontForge help to look correct.

This version contains optical versions of the math italic and symbol fonts at 7pt and 5pt, allowing better rendering in `\scriptstyle` and `\scriptscriptstyle`.