New TX font package

Michael Sharpe

September 14, 2015

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 \uppartiaOlNvar;

• 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 pSfSS 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 TeXGytreHeros, 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 \kappa has been moved from AMb to lettersA, and is now accompanied by an upright form \upvarkappa \kappa 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 TeXGytre 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}

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

\usepackage<babel options>\{babel\}
\usepackage\{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:

<encoding options>
[optional] \usepackage{substitutefont} % so you can change babel's fonts
\usepackage[babel options]{babel}
\usepackage{newtxtext}
<other font loading commands>
\usepackage{newtxmath}
\useosf % must immediately follow math package
<substitutefont commands>

Here is a specific example following this pattern.

\usepackage[LGRT1]{fontenc} % spell out all text encodings used
\usepackage[utf8]{inputenc} %
\usepackage[substitutefont]{babel} % so we can use fonts other than those in babel
\usepackage[greek,polutoniko,english]{babel}
\usepackage[largesc]{newtxtext} %
\usepackage[varqu,varl]{zi4}% inconsolata
\usepackage[cabin]{sans serif}
\usepackage[bigdelims, vvarbb]{newtxmath}
\useosf % use oldstyle figures except in math
\selectfont\usepackage{LGR,T1}{Tempora} % use Tempora to render Greek text

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 \tempfootnote.) For better control over position and size of footnote markers, use the \selectfont package after loading newtxtext. The \selectfont 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 \"une\" and "\'importe" 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:

\begin{itemize}
  \item ...
\end{itemize}
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 theorem style 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 Spacing issues

This new version of newtxtext has spacing that is a little different, in its default state, from that of the old newtxtext. In small part this is due to the finer kerning of TeXGyre Termes, but mostly because the three parameters that govern inter-word spacing are not the same.

<table>
<thead>
<tr>
<th></th>
<th>txfonts</th>
<th>Termes</th>
</tr>
</thead>
<tbody>
<tr>
<td>fontdimen2 (interword space)</td>
<td>.25em</td>
<td>.25em</td>
</tr>
<tr>
<td>fontdimen3 (interword stretch)</td>
<td>.15em</td>
<td>.2em</td>
</tr>
<tr>
<td>fontdimen4 (interword shrink)</td>
<td>.06em</td>
<td>.1em</td>
</tr>
</tbody>
</table>

That is, Termes has the same normal spacing as txfonts but its spacing is more flexible in terms of both stretch and shrink. More frequently than not, a paragraph built with Termes will occupy more space than the same built with txfonts. For this reason, the package offers some ways to change the spacing parameters. This may be important if you are trying to imitate the pagination of a document built using txfonts.

Option tighter sets the three fontdimen values to those of txfonts.

Option looser sets the three fontdimen values to \{.3em, .2em, .1em\} respectively.

If you want full control, the options spacing, stretch, shrink allow you to modify one or more of the above fontdimens. For example,

```
\usepackage[stretch=.15em,shrink=.095em]{newtxtext}
```

### 4 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, \textsc{}, \textbf{} etc. are rendered. You should also load a Typewriter font so as not to generate mysterious error messages about \texttt{} 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 styles, 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;

• cmintegra 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

% The next line is no longer needed, as newtxmath Requires it
%\usepackage{amsmath}\% loads amstext, amsbsy, amsopn but not amsymb
\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 \textsc{ams} document class such as amsart or amsbook, as is amsthm.) The integrals are as defined in txfonts. On the other hand,

%\usepackage{amsmath} % no longer needed
\usepackage[cmintegra]{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.

• If you wish to use \usepackage{amsthm}, place it before loading newtxmath or the result will be

\LaTeX Error: Command \openbox already defined.
• 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, \Gamma (or \Upsilon) gives you upright \Gamma, etc, and \Delta (or \Deltapsilon) gives you italic (i.e., slanted) versions of those letters. If you are using a text font family with properly constructed OT1-encoded versions, then, no matter what you chose as the default shape for upper case Greek letters, \mathnormal{\Omega} etc will always produce the slanted version. (The macro \mathnormal{\Omega} essentially “use the version of the symbol in letters”—i.e., the math italic form. This did not always work as expected in versions prior to 1.45.) Currently, this works as expected with newtxtext and libertine.

• 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 \mathbb{} 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 \text{\text{colonq} =, \text{eqcolon} =, \text{notin} \notin, \text{notni} \notin, \text{neq} \neq, \text{\text{\subset} \subset and \text{\subset} \subset, 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 $\hat{X}^2$ 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, \dOlNvarb 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

\[ \overline{ABC} \quad \overline{ABCD} \quad \overline{ABC} \quad \overline{ABCD} \]

- 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

\[ \overline{BC} \quad \overline{ABCD} \quad \overline{BC} \quad \overline{ABCD} \]

- 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] % not needed, as it is Required by newtxmath
\usepackage[varg,cmintegrais,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
```
% a typewriter font must be defined
\usepackage{varqu, varl}[inconsolata]
% must be loaded before newtxmath
\usepackage{amsthm}
\usepackage{libertine, cmintegra, bigdelims, vvarbb}[newtxmath]
\usepackage[scr=rsfsol]{mathalfa}
\usepackage[bm]{newtxmath}
% 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: If your text font lacks an OT1 encoded version with uppercase Greek, \textrm and \textit
applied to Greek letters won't give you what you expect.

5 Usage with Lua\TeX{} and Xe\TeX{}

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 \texttt
\usepackage[type1]{cabin}% used only by \textsf
\usepackage{amsthm}% must be loaded before newtxmath
\usepackage[libertine, bigdelims]{newtxmath}
% loads minlibertine because no other Roman text package was specified
% so that \textrm and \textbf also use minlibertine
\usepackage[scr=rsfsol]{mathalfa}
\usepackage[bm]{newtxmath}
% 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, \textrm and
\textbf will render with fbb-LF, though math italic and math Greek letters will be from libertine. (Note
that one specifies the encoding and redefines \textdefault. 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{\textdefault}{fbb-LF}\% Roman font for use in math mode
\usepackage[scaled=.85]{beramono}\% used only by \mathbbt
\usepackage[type1]{cabin}\% used only by \mathsf
\usepackage[amsthm]\% load before newtxmath
\usepackage[libertine,cmintegals,bigdelims,vvarbb]{newtxmath}
% does not load minlibertine because another Roman text package was specified
\usepackage[rsfs]{mathalpha}\% load after all math to give access to bold math
\usepackage[no-math]{fontspec}\% process with XeLaTeX or LuaLaTeX
\usepackage{libertine}

### 6 Alternate forms of glyphs

Several math glyphs have alternate forms:

<table>
<thead>
<tr>
<th>Command</th>
<th>Result</th>
<th>Alternate Commands</th>
<th>Alternate Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>\emptyset</td>
<td>$\emptyset$</td>
<td>\varnothing, \emptysetAlt \varnothing, $\emptyset$</td>
<td></td>
</tr>
<tr>
<td>\forall</td>
<td>$\forall$</td>
<td>\forallAlt \forall</td>
<td></td>
</tr>
<tr>
<td>\exists</td>
<td>$\exists$</td>
<td>\existsAlt \exists</td>
<td></td>
</tr>
<tr>
<td>\nexists</td>
<td>$\nexists$</td>
<td>\nexistsAlt \nexists</td>
<td></td>
</tr>
</tbody>
</table>

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

### 7 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.
8 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 minion\newtx package that must be downloaded from CTAN. tug.org and installed separately.

9 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: AMSm (a combination of the old AMSa and AMSb)
5: lettersA
6: symbolsC
7: largesymbolsTXA
8: boldoperators
9: boldletters
10: boldsymbols
11: boldlargesymbols

NOTES:

• The operators font is essentially the Roman text font, used for names of operators and as the target for \mathrm—it’s bold version is used as the target for \mathbf;

• operators is defined to be the OT1 encoded version of the text font in cases where that version is known to contain upright uppercase Greek letters in its forst eleven slots—eg, newtxtex, libertine.

• 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 AMSm as well as symbolsC, which can save you at least two 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 bold letters 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])

10 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight</th>
<th>Command</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math Italic</td>
<td>Regular</td>
<td>\hat{\textit{x}}</td>
<td>\i</td>
</tr>
<tr>
<td>Math Italic</td>
<td>Bold</td>
<td>\bm{\hat{\textit{x}}}</td>
<td>\i</td>
</tr>
<tr>
<td>Roman</td>
<td>Regular</td>
<td>\hat{\textsf{x}}</td>
<td>\i</td>
</tr>
<tr>
<td>Roman</td>
<td>Bold</td>
<td>\bm{\hat{\textsf{x}}}</td>
<td>\i</td>
</tr>
</tbody>
</table>

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

• $\mathbf{x}$ produces $x$;

• $\mathbb{\text{mathrm}(x)}$ produces $x$ (same as previous but may offer improved spacing);

• $\bm{x}$ produces $x$ (not roman);

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

• $\bm{\dot{x}}$ produces $\dot{x}$ (bold but not roman);

• the macro definition

\newcommand{\xyvec}{R}{E

\ensuremath{\textbf{C1\mkern1.5mu}R\mkern1.5mu\textbf{I}R\mkern1.5mu\textbf{J}}}

allows you to write $\xyvec{x}{+y}$ to output $x\hat{1} + y\hat{\j}$;

• $\Gamma$ produces $\Gamma$ (bold Gamma);
• $\bm{\hat{\Gamma}}$ produces $\hat{\Gamma}$ (bold Gamma with bold accent).

(The last two assume that you have effectively set the option \texttt{uprightgreek}—the default.)

11 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 \texttt{\textbackslash mathbb} is quite ugly and indistinct, but does cooperate with the bolding macros \texttt{\bm} and \texttt{\textbackslash boldsymbol};

• the original variant form called with the macro \texttt{\textbackslash varmathbb} is better, but the macro conflicts with \texttt{\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 \texttt{\varmathbb} which allows you to insert an argument with more than one character, like \texttt{\textbackslash varmathbb\{ABC\}}. Another problem with \texttt{\varmathbb} is that it conflicts with \texttt{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 \texttt{\textbackslash vmathbb\{A\}} and \texttt{\vvmathbb\{A\}}, which both cooperate with \texttt{\bm} and \texttt{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 \texttt{\vvmathbb} provided to access this alphabet allows only a single character for its argument. The new option \texttt{vvarbb} effectively makes \texttt{\mathbb} mean the same as \texttt{\vvmathbb}. (The reason for including these in the \texttt{newtx} package rather than calling them from the \texttt{mathalfa} package is that \texttt{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 $1=\vvmathbb{1}$ useful in specifying an indicator, AKA characteristic function. Here are some examples:

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th>Bold</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>$\texttt{\mathbb{R}}$ $\mathbb{R}$</td>
<td>$\texttt{\bm{\mathbb{R}}}$ $\bm{\mathbb{R}}$</td>
<td></td>
</tr>
<tr>
<td>Variant 1</td>
<td>$\texttt{\textbackslash varmathbb{R}}$ $\mathbb{R}$</td>
<td>$\texttt{\vmathbb{R}}$ $\mathbb{R}$</td>
<td>Bold is same as regular</td>
</tr>
<tr>
<td>...or</td>
<td>$\texttt{\textbackslash vmathbb{R}}$ $\mathbb{R}$</td>
<td>$\texttt{\textbackslash boldmath \vmathbb{R}}$ $\mathbb{R}$</td>
<td>Single char. argument</td>
</tr>
<tr>
<td>Variant 2</td>
<td>$\texttt{\textbackslash vvmathbb{R}}$ $\mathbb{R}$</td>
<td>$\texttt{\textbackslash boldmath \vvmathbb{R}}$ $\mathbb{R}$</td>
<td>Make a macro for this!</td>
</tr>
</tbody>
</table>

12 Samples from free Times and Libertine packages

\texttt{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
\[ \Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt, \]
with upright $\pi$, $e$ 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.

\textbf{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
\[ \Phi(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{u} e^{-t^2/2} \, dt, \]
with upright $\pi$, $e$ 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.
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

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

with upright $\pi$, $e$ 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.

\textbf{Libertine and MathTimePro2:}

\texttt{\usepackage{libertine}}
\texttt{\usepackage[T1]{fontenc}}
\texttt{\usepackage[default]{mathpazo}}

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

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

with upright $\pi$, $e$ 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.

Liberine 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

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

with upright \( \pi, e \) 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:

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

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

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

with upright \( \pi, e \) 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.

13 Items installed

As well as a collection of PostScript fonts, virtual fonts, font definition files and the central \texttt{newtxttext.sty} and \texttt{newtxmath.sty} files, the package contains one map file \texttt{newtx.map} that must be enabled for the package to function correctly. Its name was changed from \texttt{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 \texttt{mathnotes.pdf} adds details about the sources for the math fonts, though it is rather cursory.)

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

16