New TX font package

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1 Introduction

The `txfonts` package by Young Ryu has been available for over ten years but has been corrected very little since its introduction. It is meant to be a complete text and math package with roman text font provided by Times or 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. The additional glyphs, whether taken from free sources or designed by him, are generally of high quality, but the accompanying metrics are not, making the math inconsistently spaced, but so cramped that neighboring symbols collide not infrequently.

The goal of this new project is use his glyphs along with a few additions and with completely reworked metrics which are generally looser, but not as loose as Computer Modern math, to make a math package that works with not only Times, but also with fonts that are intermediate in weight between Computer Modern and Times. The free font Linux Libertine is one particular target, as it is of nearly the same x-height as Computer Modern, but, not being a *modern* font, it 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 a rough measure of weight in math mode, the default line width in Computer Modern math is 40em, in MathTime Pro 2, it is 46em, and in txfonts, the value is 56em. (The Times default line width as estimated from the thickness of each line segment is its = sign is 65em. Unlike txfonts, Mathtime Pro 2 geometric glyphs are not of uniform thickness, so a comparison based on just this number is somewhat misleading.)

The new version makes the following changes:

- 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;

- 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;

- 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.

2   Text mode options

The text mode environment invoked by

\usepackage{newtxtext}

has two options: you may write

\usepackage[scaled=.93]{netxtext}

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 option osf instructs the text fonts to use old-style figures 1234567890 rather than the default lining figures 1234567890.

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;

- `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.

- `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.

- `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.

- 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.

EXAMPLE 1:

```
\usepackage{newtxtext} % T1, lining figures so math uses lf
\usepackage{textcomp} % required for special glyphs
\usepackage{amsmath}
\usepackage[varg,cmintegrals,cmbraces]{newtxmath}
\usepackage{bm} % load after all math to give access to bold math
\renewcommand{\rmdefault}{ntxrj} %old-style figures in text, not in math
```

EXAMPLE 2:

```
\usepackage[nf]{libertine} % a bit lighter than Times--no osf in math
\usepackage[T1]{fontenc} %the only LaTeX encoding that works with libertine
\usepackage{textcomp} % required to get special symbols
\usepackage[scaled=.85]{beramono}% a typewriter font must be defined
\usepackage{amsmath}
\usepackage[varg,cmintegrals,cmbraces]{newtxmath}
\renewcommand*{\rmdefault}{fxlj} %old-style figures in text, not math
\def\libertine{\fontfamily{fxlj}\selectfont}
\usepackage[bb=boondox,frak=boondox,scr=boondoxo]{mathalfa}
```

```
\usepackage{bm}% load after all math to give access to bold math
```

```
\usepackage[nf]{libertine} % a bit lighter than Times--no osf in math
\usepackage[T1]{fontenc} %the only LaTeX encoding that works with libertine
\usepackage{textcomp} % required to get special symbols
\usepackage[scaled=.85]{beramono}% a typewriter font must be defined
\usepackage{amsmath}
\usepackage[libertine,cmintegrals,cmbraces]{newtxmath}
\renewcommand*{\rmdefault}{fxlj} %old-style figures in text, not math
\def\libertine{\fontfamily{fxlj}\selectfont}
\usepackage[bb=boondox,frak=boondox,scr=rsfso]{mathalfa}
\usepackage{bm}% load after all math to give access to bold math
```

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   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	`$\hat{\textrm{\i}}$`	$\hat{\textrm{\i}}$
Roman	Bold	`$\bm{\hat{\textbf{\i}}}$`	$\boldsymbol{\hat{\textbf{\i}}}$

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

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

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

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

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

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

- the macro definition

  ```
  \newcommand{\xyvec}[2]{\ensuremath{#1\bm{\textbf{\i}}#2\bm{\textbf{\j}}}}
  ```

allows you to write `\xyvec{x}{+y}` to output $x_1 + y_J$;

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

- `$\bm{\hat{\Gamma}}$` produces **Γ̂** (bold Gamma with bold accent).

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

5 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.

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.

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

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

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 quite spread out;

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

- plenty of space between square and t in exponent.

```
\usepackage{libertine}
\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

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

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

- 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[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

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

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

- 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.

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;

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

6 Items installed

As well as a collection of virtual fonts, font definition files and the central `newtxtext.sty` and `newtxmath.sty` files, the package contains one map file `ntx.map` that must be enabled for the package to function correctly. It contains the following items. The two `fxl*.pfb` files to which they refer are part of the Libertine-Legacy collection that is part of TeX Live. The map file `libertine.map` must not have been disabled. The other `.pfb` files are either part of the txfonts or are fonts derived from them or from the Computer Modern fonts in some manner.

```
ntxexmods NTXEXMODS <ntxexmods.pfb
ntxbexmods NTXBEXMODS <ntxbexmods.pfb
ntxexb NTXEXB <ntxexb.pfb
ntxbexb NTXBEXB <ntxbexb.pfb
rtxmio rtxmi " -.167 SlantFont " <rtxmi.pfb
rtxbmio rtxbmi " -.167 SlantFont " <rtxbmi.pfb
```

```
rfxlri-alt LinLibertineI " LibertineAltEncoding ReEncodeFont "
 <[libertinealt.enc <fxlri.pfb
rfxlbi-alt LinLibertineBI " LibertineAltEncoding ReEncodeFont "
 <[libertinealt.enc <fxlbi.pfb
```

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 to some of the unencoded alternate glyphs—eg, Greek letters, J.alt and v.alt.