PARAMETRIC MATH SYMBOL FONT

Bogusław Jackowski, Piotr Strzelczyk, Piotr Pianowski
## An OpenType math font contents: repetition

According to the “Draft Unicode Technical Report #25” by Barbara Beeton, Asmus Freytag and Murray Sargent III, math font should contain the following groups of glyphs:

<table>
<thead>
<tr>
<th>Plain (upright, serifed)</th>
<th>Latin, Greek and digits</th>
</tr>
</thead>
<tbody>
<tr>
<td>italic</td>
<td>Latin and Greek</td>
</tr>
<tr>
<td>bold</td>
<td>Latin, Greek and digits</td>
</tr>
<tr>
<td>bold italic</td>
<td>Latin and Greek</td>
</tr>
<tr>
<td>sans-serif</td>
<td>Latin and digits</td>
</tr>
<tr>
<td>sans-serif italic</td>
<td>Latin</td>
</tr>
<tr>
<td>sans-serif bold</td>
<td>Latin, Greek and digits</td>
</tr>
<tr>
<td>sans-serif bold italic</td>
<td>Latin</td>
</tr>
<tr>
<td>script (calligraphic)</td>
<td>Latin, Greek and digits</td>
</tr>
<tr>
<td>bold script (calligraphic)</td>
<td>Latin and Greek</td>
</tr>
<tr>
<td>Fraktur</td>
<td>Latin</td>
</tr>
<tr>
<td>bold Fraktur</td>
<td>Latin</td>
</tr>
<tr>
<td>double-struck</td>
<td>Latin and digits</td>
</tr>
<tr>
<td>monospace</td>
<td>Latin and digits</td>
</tr>
</tbody>
</table>
An OpenType math font contents: sub- and superscripts

The “Draft Unicode Technical Report #25” does not specifies details concerning sub- and superscripts of the first and second order; virtually, any glyph can be accompanied by its sub- and/or superscript counterpart, although it would unnecessarily inflate the font. Thus, in T\textup{\TeX} Gyre fonts (each counting more than 4000 glyphs), we limited the number of sub- and superscripts to such glyphs that can likely appear in such a role (according to our intuition).
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CM, optical (fancy) scaling: \( abc \quad abc \quad abc \quad abc \)
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CM, optical (fancy) scaling: $\text{abc abc abc}$

Euler, non-uniform scaling: $\text{abc abc abc}$
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\TeX Gyre, non-uniform scaling: \[ \text{abc abc abc} \]
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CM, optical (fancy) scaling:

\begin{align*}
  a & bc & abc & abc \\
  a & bc & abc & abc
\end{align*}

Euler, non-uniform scaling:

\begin{align*}
  a & bc & abc & abc \\
  a & bc & abc & abc
\end{align*}

\TeX\ Gyre, non-uniform scaling:

\begin{align*}
  a & bc & abc & abc \\
  a & bc & abc & abc
\end{align*}

default, uniform scaling:

\begin{align*}
  a & bc & abc & abc \\
  a & bc & abc & abc
\end{align*}
The assembling of an OpenType math font

**MAIN FONT**
- aąbcćAĄBCĆ012
- abcABC012
- abcABCabcABC

**GREEK FONT**
- αβγΑΒΓαβγΑΒΓ
- αβγΑΒΓαβγΑΒΓ

**HEBREW 4-LETTER FONT**
- נבגא

**MATH SYMBOLS AND SHAPES**
- ∫∮∮∮≤≥→⇒⇒

**SANS SERIF FONT**
- abcABC012abcABC012
- abcABCabcABCαβγδε

**CALLIGRAPHIC FONT**
- abcABCabcABC

**DOUBLE STRUCK FONT**
- abcABC012ΩΠΓΠ

**FRAKTUR FONT**
- abcABCabcABC

**MONOSPACE FONT**
- ABCabc012

**PARAMETRIC MATH SYMBOL FONT**
The assembling of an OpenType math font
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FONT EDITOR

MATH FONT

MAIN FONT
GREEK FONT
HEBREW 4-LETTER FONT
SANS SERIF FONT
CALLIGRAPHIC FONT
DOUBLE STRUCK FONT
FRAKTUR FONT
MONOSPACE FONT

FORMATTING EDITORS:  WORD  TeX  et al.
The assembling of an OpenType math font

MAIN FONT
GREEK FONT
MATH SYMBOLS AND SHAPES
HEBREW 4-LETTER FONT
SANS SERIF FONT
DOUBLE STRUCK FONT
CALLIGRAPHIC FONT
FRAKTUR FONT
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Lua\TeX

to a great extent may play a role of a FONT EDITOR
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MAIN FONT
GREEK FONT
MATH SYMBOLS AND SHAPES
HEBREW 4-LETTER FONT
SANS SERIF FONT
DOUBLE STRUCK FONT
CALLIGRAPHIC FONT
FRAKTUR FONT
MONOSPACED FONT

LuatEX
to a great extent may play a role of a FONT EDITOR
Lua\TeX as a “font editor”

\nopagenumbers \input otf-math
\OMtrm{DejaVuSans.ttf}
\OMtbf{DejaVuSans-Bold.ttf}
\OMtit{DejaVuSans-Oblique.ttf}
\OMtbi{DejaVuSans-BoldOblique.ttf}
\OMmat{dejavu-math-1027.otf}
\OMsize{12pt}
\OMbaselines{1.2em}{0.3em}{0.3em}
\OMfix
Lua\TeX{} as a "font editor"

\begin{verbatim}
\nopagenumbers \input otf-math
\OMotrm{DejaVuSans.ttf}
\OMotbf{DejaVuSans-Bold.ttf}
\OMotit{DejaVuSans-Oblique.ttf}
\OMotbi{DejaVuSans-BoldOblique.ttf}
\OMmat{dejavu-math-1027.otf}
\OMsize{12pt}
\OMbaselines{1.2em}{0.3em}{0.3em}
\OMfix

\$\$
\it
\delta_{ij} = \begin{cases}
0 & \text{for } i = j \\
1 & \text{for } i \neq j
\end{cases}
= \begin{pmatrix}
1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{pmatrix}
\$
\end{verbatim}
\sqrt{\frac{1}{2}} \approx 0.7 \quad f'(x) = \left( \frac{1}{x^2} \right)
LuaTeX as a “font editor”

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$$
\langle \langle (x^2)^2 \rangle^2 \rangle^2
$$

$$
\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\left(\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x\right)^x$$
Question: so, what is missing
Question: so, what is missing
Answer: handling details
Question: so, what is missing
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Answer: handling details
The sketch of the solution
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We can formulate the problem to solve as follows: given (say, by a customer) a font, add an adequate, i.e., optically consistent, math companion to be used in (Lua)TEX with the given font.
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0. The procedure seems straightforward
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2. Prepare a generic set of METAPOST (METATYPE1) macros
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1. Prepare a generic set of (Lua)TEX macros
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3. Provide a set of adequate parameters for the math companion for a given font (controlling ovalness, incisions, thickness of stems, x-height, etc.)
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The good news is that the points 1 and 2 are, to some extent, accomplished. We use a Lua\TeX{} (p. 1) package (exploiting heavily Hans Hagen’s font handling macros—thanks!) in our office; the METATYPE1 (p. 2) macros which we use for generating GUST e-Foundry fonts are to a great extent parametric, although from font to font some modules needed amending and enhancing.
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the allegory of the state of the art (in the case of doubts, consult Willi Egger)
That’s all, so far…—thank you for your attention!
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Let’s hope that the next BachoTeX meeting will be a little bit warmer (as far as the weather is concerned). Let’s check...

CREDITS

Cello back photo by Steffen Nowak
http://www.nowakviolins.co.uk/tonewood%20violin,%20viola.htm

Sun face
http://cliparts.co/woodcut-clipart