Garamond-Math, Ver. 2022-01-03

Yuansheng Zhao, Xiangdong Zeng

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1 Introduction

Garamond-Math is an open type math font matching the *EB Garamond (Octavio Pardo)*[1] and *EB Garamond (Georg Mayr-Duffner)*[2]. Many mathematical symbols are derived from other fonts, others are made from scratch. The metric is generated with a python script. Issues, bug reports, forks and other contributions are welcome. Please visit GitHub[3] for development details.

A minimal example with `unicode-math` package is as following:

```
%Compile with `xelatex' command
\documentclass{article}
\usepackage[math-style=ISO, bold-style=ISO]{unicode-math}
\setmainfont{EB Garamond}%You should have installed the font
\setmathfont{Garamond-Math.otf}[StylisticSet={7,9}]%Use StylisticSet that you like
\begin{document}
    \[x^3+y^3=z^3.\]
\end{document}
```

The result should be

$$x^3 + y^3 = z^3.$$

2 Alphabets & StylisticSets

Latin and Greek (StylisticSet 4/5 give semi/extra bold for `\symbf`)

$ABCDEFGHIJKLMNOPQRSTUVWXYZ$

$abcdefghijklmnopqrstuvwxyz$

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

$\boldsymbol{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$

$\boldsymbol{abcdefghijklmnopqrstuvwxyz}$

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

$ΑΒΓΔΕΖΗΘϴΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ$

$αβγδεϵζηθϑικϰλμνξοπϖρϱσςτυϕφχψω$

ΑΒΓΔΕΖΗΘϴΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ

αβγδϵεζηθϑικϰλμνξοπϖρϱσςτυϕφχψω

$\boldsymbol{ΑΒΓΔΕΖΗΘϴΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ}$

$\boldsymbol{αβγδϵεζηθϑικϰλμνξοπϖρϱσςτυϕφχψω}$

[1] https://ctan.org/pkg/ebgaramond/, and https://github.com/octaviopardo/EBGaramond12/
[2] https://github.com/georgd/EB-Garamond/
[3] https://github.com/YuanshengZhao/Garamond-Math/

ΑΒΓΔΕΖΗΘϴΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ

αβγδεϵζηθϑικϰλμνξοπϖρϱσςτυϕφχψω

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

Sans and Typewriter: From Libertinus Math[4]

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

`ABCDEFGHIJKLMNOPQRSTUVWXYZ`

`abcdefghijklmnopqrstuvwxyz`

Blackboard (StylisticSet 1 → rounded XITS Math[5])

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

Script: Rounded XITS Math [StylisticSet 3 → scaled CM; 8 → Garamond-compatible ones (experimental)]

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

Fraktur: From Noto Sans Math[6]

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

[4] https://github.com/khaledhosny/libertinus/

[5] https://github.com/khaledhosny/xits/

[6] https://github.com/googlefonts/noto-fonts/

Digits: Same width between weight and serif/sans

3.141592653589793238462643383279502884197169399375105820974944592307816406286

3.141592653589793238462643383279502884197169399375105820974944592307816406286

3.141592653589793238462643383279502884197169399375105820974944592307816406286

`\partial`: (StylisticSet 2 → curved ones)

$$\partial_\mu(\partial^\mu\phi) - \epsilon^{\lambda\mu\nu}\boldsymbol{\partial}_\mu(\boldsymbol{A}_\lambda\boldsymbol{\partial}_\nu\boldsymbol{f})$$

$$\partial_\mu(\partial^\mu\phi) - \epsilon^{\lambda\mu\nu}\boldsymbol{\partial}_\mu(\boldsymbol{A}_\lambda\boldsymbol{\partial}_\nu\boldsymbol{f})$$

`\hbar`: (StylisticSet 6 → horizontal bars)

$\hbar$ $\hbar$

Italic *h*: (StylisticSet 10 → out-bending ones)

$$\hbar = \frac{\boldsymbol{h}}{2\pi} \qquad \hbar = \frac{\boldsymbol{h}}{2\pi}$$

`\tilde`: (StylisticSet 9 → "normal" ones)

$\tilde{F}$ $\tilde{F}$

`\int`: (StylisticSet 7 → a variant with inversion symmetry)

$$\oint_{\partial\Sigma} \vec{E}\cdot \mathrm{d}\vec{l} = -\frac{1}{c}\frac{\mathrm{d}}{\mathrm{d}t}\iint_\Sigma \vec{B}\cdot \mathrm{d}\vec{S}$$

$$\oint_{\partial\Sigma} \vec{E}\cdot \mathrm{d}\vec{l} = -\frac{1}{c}\frac{\mathrm{d}}{\mathrm{d}t}\iint_\Sigma \vec{B}\cdot \mathrm{d}\vec{S}$$

Binany Operators: (StylisticSet 11 → larger ones)

$$s = A + b \times 1 \div x^3$$

$$s = A + b \times 1 \div x^3$$

Other Symbols

⓪①②③④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭⑮⑯⑰⑱⑲⑳㉑㉒㉓㉔㉕㉖㉗㉘㉙㉚㉛㉜㉝㉞㉟㊱㊲㊳㊴㊵㊶㊷㊸㊹㊺㊻㊼㊽㊾㊿
⓿❶❷❸❹❺❻❼❽❾❿⓫⓬⓭⓮⓯⓰⓱⓲⓳⓴
①②③④⑤⑥⑦⑧⑨⑩
ⒶⒷⒸⒹⒺⒻⒼⒽⒾⒿⓀⓁⓂⓃⓄⓅⓆⓇⓈⓉⓊⓋⓌⓍⓎⓏ
🅐🅑🅒🅓🅔🅕🅖🅗🅘🅙🅚🅛🅜🅝🅞🅟🅠🅡🅢🅣🅤🅥🅦🅧🅨🅩
ⓐⓑⓒⓓⓔⓕⓖⓗⓘⓙⓚⓛⓜⓝⓞⓟⓠⓡⓢⓣⓤⓥⓦⓧⓨⓩ
♔♕♖♗♘♙♚♛♜♝♞♟

Extensible Arrow Hack

The font contains the math table for constructing extensible arrow. However `unicode-math` does not provide an interface to that. In LuaTEX one can use `\Uhextensible`[7]. A more general solution is to add the following code in preamble.

```
\usepackage{extarrow} %or mathtools
\makeatletter
\renewcommand{\relbar}{\symbol{"E010}\mkern-.2mu\symbol{"E010}\mkern1.8mu}
\renewcommand{\Relbar}{\symbol{"E011}\mkern-.2mu\symbol{"E011}\mkern1.8mu}
\makeatother
```

Then `\xleftarrow` and other commands will work:

$$CH_3COOH + C_2H_5OH \xrightarrow[\Delta]{H_2SO_4} CH_3COOC_2H_5 + H_2O.$$

[7]https://tex.stackexchange.com/questions/423893/

3 Known Issue

- Fake optical size. EB Garamond does not contain a complete set of glyphs (normal + bold + optical size of both weights). The "optical size `ssty`" is made by interpolating different weights at the present (without this, the double script is too thin to be readable).

4 Equation Samples

$$1 + 2 - 3 \times 4 \div 5 \pm 6 \mp 7 \dotplus 8 = -a \oplus b \otimes c - \{z\}$$

$$\forall \epsilon, \exists \delta : x \in A \cup B \subset S \cap T \not\trianglerighteq U$$

$$R^{\mu}_{\ \nu\kappa\lambda} = \partial_\kappa \Gamma^{\mu}_{\lambda\nu} - \partial_\lambda \Gamma^{\mu}_{\kappa\nu} + \Gamma^{\mu}_{\kappa\sigma}\Gamma^{\sigma}_{\lambda\nu} - \Gamma^{\mu}_{\lambda\sigma}\Gamma^{\sigma}_{\kappa\nu}$$

$$T'^{\beta_1\cdots\beta_l}_{\alpha_1\cdots\alpha_k} = T^{j_1\cdots j_l}_{i_1\cdots i_k} \frac{\partial x^{i_1}}{\partial x'^{\alpha_1}} \cdots \frac{\partial x^{i_k}}{\partial x'^{\alpha_k}} \frac{\partial x'^{\beta_1}}{\partial x^{j_1}} \cdots \frac{\partial x'^{\beta_l}}{\partial x^{j_l}}$$

$$\int_{\sqrt{\frac{1-mu+m\Delta/k^2}{2mu/k}}}^{X_p} \widehat{1+2+3+4} + \overparen{5+6+7+8}$$

$$x \leftarrow y \leftrightarrow w \Rightarrow b \Leftrightarrow c \uparrow y \updownarrow w \Downarrow b \Updownarrow c \searrow p \swarrow px \leftharpoondown x \upharpoonleft X \mapsfrom Y \mapsto Z \mapsup f \rightleftarrows f \upandownarrows fb \Rrightarrow b \Lleftarrow p$$

$$\int_0^1 \frac{\ln(x+1)}{x} \mathrm{d}x = \int_0^1 \sum_{i=1}^{\infty} \frac{(-x)^{i-1}}{i} \mathrm{d}x = \sum_{i=1}^{\infty} \int_0^1 \frac{(-x)^{i-1}}{i} \mathrm{d}x = \sum_{i=1}^{\infty} \frac{(-1)^{i+1}}{i^2} = \frac{\pi^2}{12}$$

$$\int\limits_0^\infty \int_0^\infty \sum_{i=1}^{\infty} \prod_{j=i}^{\infty} \coprod_{k=i}^{\infty} \oiiint \intclockwise \ointclockwise \ointctrclockwise \varointclockwise$$

$$\left(\left(\left(\left((x)\right)\right)\right)\right) \quad \left[\left[\left[[x]\right]\right]\right] \quad \left\{\left\{\left\{\{x\}\right\}\right\}\right\} \quad \left|\left|\left||x|\right|\right|\right| \quad \left\|\left\|\left\|\|x\|\right\|\right\|\right\| \quad \left\langle\left\langle\left\langle\left\langle\langle x\rangle\right\rangle\right\rangle\right\rangle\right\rangle$$

$$\left\lvert\left(\left((x)\right)\right)\right\rvert \quad \left\lvert\left\lfloor\left\lfloor\lfloor x\rfloor\right\rfloor\right\rfloor\right\rvert \quad \left\lvert\left\lceil\left\lceil\lceil x\rceil\right\rceil\right\rceil\right\rvert$$

$$\langle x| + |x\rangle + \langle\alpha|\beta\rangle + |\alpha\rangle\langle\beta| + \left\langle\frac{1}{2}\right| + \left|\frac{1}{2}\right\rangle + \left\langle\frac{1}{2}\middle|\frac{1}{2}\right\rangle + \left|\frac{1}{2}\right\rangle\left\langle\frac{1}{2}\right| + \left\langle\frac{a^2}{b^2}\right| + \left|\frac{\mathrm{e}^{x^2}}{\mathrm{e}^{y^2}}\right\rangle$$

❶❷❸❹❺❻❼❽❾❿ with leading ⓿: ⓿❶❷❸❹❺❻❼❽❾❿ $+ ABC^{⓪①②③④⑤⑥⑦⑧⑨⑩}$

$$\begin{pmatrix} u_0 \\ u_1 \\ \vdots \\ u_{N-1} \end{pmatrix} = \sum_{k>0} \left[\begin{pmatrix} 1 \\ \cos ka \\ \vdots \\ \cos k\,(N-1)\,a \end{pmatrix} \underbrace{C_{k+}\cos(\omega_k t + \varphi_{k+})}_{\frac{2}{\sqrt{N}} q_{k+}} + \begin{pmatrix} 0 \\ \sin ka \\ \vdots \\ \sin k\,(N-1)\,a \end{pmatrix} \underbrace{C_{k-}\cos(\omega_k t + \varphi_{k-})}_{\frac{2}{\sqrt{N}} q_{k-}} \right]$$

$$\begin{aligned}
\mathscr{F}^{-1}(|j\rangle) &= \frac{1}{\sqrt{2^n}} \sum_{k=0}^{2^n-1} \exp\left(-2\pi\mathrm{i}\frac{jk}{2^n}\right)|k\rangle. \\
&= \frac{1}{\sqrt{2^n}} \sum_{k_{n-1}=0}^{1} \cdots \sum_{k_0=0}^{1} \exp\left(-2\pi\mathrm{i}j \sum_{l=0}^{n-1} \frac{2^l k_l}{2^n}\right)|k_{n-1}\cdots k_0\rangle \\
&= \frac{1}{\sqrt{2^n}} \sum_{k_{n-1}=0}^{1} \cdots \sum_{k_0=0}^{1} \bigotimes_{l=1}^{n} \left[\exp\left(-2\pi\mathrm{i}j\frac{k_{n-l}}{2^l}\right)|k_{n-l}\rangle\right] \\
&= \frac{1}{\sqrt{2^n}} \bigotimes_{l=1}^{n} \left[\sum_{k_{n-l}=0}^{1} \exp\left(-2\pi\mathrm{i}j\frac{k_{n-l}}{2^l}\right)|k_{n-l}\rangle\right] \\
&= \frac{1}{\sqrt{2^n}} \bigotimes_{l=1}^{n} \left[|0\rangle_{n-l} + \mathrm{e}^{-2\pi\mathrm{i}j/2^l}|1\rangle_{n-l}\right] \\
&= \frac{1}{\sqrt{2^n}} \bigotimes_{l=1}^{n} \left[|0\rangle_{n-l} + \mathrm{e}^{-2\pi\mathrm{i}(\overline{0.j_{l-1}\cdots j_0})}|1\rangle_{n-l}\right].
\end{aligned}$$

$$
\begin{aligned}
S = {} & \frac{m}{2}\int_0^{t_\mathrm{f}}\left[\left(-\omega x_\mathrm{i}\sin\omega t + \omega\frac{x_\mathrm{f} - x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\cos\omega t\right)^2 + \sum_{n=1}^{\infty}\left(\frac{a_n n\pi}{t_\mathrm{f}}\right)^2\cos^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t \\
& - \frac{m\omega^2}{2}\int_0^{t_\mathrm{f}}\left[\left(x_\mathrm{i}\cos\omega t + \frac{x_\mathrm{f} - x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\sin\omega t\right)^2 + \sum_{n=1}^{\infty}{a_n}^2\sin^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t \\
= {} & \sum_{n=1}^{\infty}\int_0^{t_\mathrm{f}}\left[\frac{m}{2}\left(\frac{a_n n\pi}{t_\mathrm{f}}\right)^2\cos^2\frac{n\pi t}{t_\mathrm{f}} - \frac{m\omega^2}{2}{a_n}^2\sin^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t \\
& + \frac{m\omega^2}{2}\int_0^{t_\mathrm{f}}\left[{x_\mathrm{i}}^2 - \left(\frac{x_\mathrm{f} - x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\right)^2\right]\left(\sin^2\omega t - \cos^2\omega t\right)\,\mathrm{d}t \\
& - \frac{m\omega^2}{2}\int_0^{t_\mathrm{f}} 4x_\mathrm{i}\left(\frac{x_\mathrm{f} - x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\right)\left(\sin\omega t\cos\omega t\right)\,\mathrm{d}t.
\end{aligned}
$$

$$
\begin{aligned}
U\left(x_\mathrm{f}, t_\mathrm{f}; x_\mathrm{i}, t_\mathrm{i}\right) = {} & \sqrt{\frac{m\omega}{2\pi\mathrm{i}\hbar\sin\left[\omega\left(t_\mathrm{f} - t_\mathrm{i}\right)\right]}} \\
& \times\exp\left\{\frac{\mathrm{i}m\omega}{2\hbar\sin\left[\omega\left(t_\mathrm{f} - t_\mathrm{i}\right)\right]}\left[\left({x_\mathrm{i}}^2 + {x_\mathrm{f}}^2\right)\cos\left[\omega\left(t_\mathrm{f} - t_\mathrm{i}\right)\right] - 2x_\mathrm{i}x_\mathrm{f}\right]\right\}.
\end{aligned}
$$