

We are proud to introduce the `mathabx` font series—extended and extendable series of mathematical symbols. Their creation has been motivated by the poor quality of some other well spread series. We first started to design anew a few symbols to reach a quite complete system. But completeness is a quite relative notion. It depends on previously available symbols, commonly used or not, on our very own needs, and, at last, on our personal whim. This work must be subject to any (friendly) remark and every (warm) encouragements. *This distribution is still (April 29, 2002) at a “merely for evaluation” level. It is so since a couple of years, but I still want to change a few symbols, especially some large ones.* Please check my home page at Poitiers (France) to get further informations:

<http://www-math.univ-poitiers.fr/~phan>

About the quality of `mathabx`’s symbols, we based ourself mostly on *Computer Modern* to overpass it: more complex mathematical constructions and designs, careful digitness. Since this is an unbounded task, improvements are always conceivable, and observations are welcome.

The great problem is the encoding matter. We tried to build a coherent set. But this doesn’t follow prescriptions of the two or three groups working on this kind of question. Our contribution is an element of reflection on this subject.

By now, there are 3 main series of fonts: `matha`, `mathb` and `mathx`. The `matha` series consist in quite usual mathematical symbols, more precisely it contains the, say, 64 mathematical symbols one can use and suppose other ones know their meaning. The `mathb` series is a kind of twin of `matha`, but it is the one people should not show outside of the house: these symbols do not have a very well known meaning and, thus, should not be used. The `mathx` series is the set of extensible delimiters and large operators fitting `matha` and `mathb`; its encoding doesn’t match at all the `cmex`’ one, but it may change in the future.

Since a metafont designer doesn’t always know when to stop creating or coding stuff, many pieces of code remained once the three former series where filled. The remaining stuff has been putted in `mathu` (*u* stands for unsupported) and in `mathux` (*ux* stands for unsupported extensible). These two series also contain “work in progress”-material as a full OT1 implementation of calligraphic characters. If this last task find an end, there would be a `mathc` series—where *c* would stand for calligraphic.

Let’s go for the essential stuff. Thereafter will be loaded plain $\TeX$ definitions files related to these fonts families. Assigning any value to the control sequence `\proofmode` like `\let\proofmode=!`, for instance, the definition of every symbol will be made together with the print of the related informations. The control sequence `\proofmode` will be reset to `\undefined` at the end of the loading.

About the names of the different control sequences, we mostly tried to conform usual names. If in the following there is some apparent mismatch with *AMS* denomination, it is normally supported. Below, every already known mathematical

symbol (*Computer Modern* or *AMS*) is printed before the new one and surrounded by parentheses.

Part of this documentation is in some poor english, the other in a not so better french. We do apologize for this.

1. Progress

April 29, 2002. First posting on CTAN.

June 19, 2002. A few changes have been done:

- Some large symbols are now thicker (`\bigcup`, etc.);
- “Flat cups” have been introduced (`\bigcup`, etc.), that means that the roundish parts of those symbols are now “flatter”.

November 16, 2002.

- Some work has been done on the calligraphic set. The uppercase subset should be exactly the Computer Modern’s one. So kerning has to be done in order to get a nice stuff.
- The series *mathux* are in progress. It will contain more extensible symbols (unnecessary I think, so still unsupported).
- Binary operators `\sprod` and `\scoprod` have been added to *matha* at locations "3C and "3D. I love those symbols and I believe that they must lie on the main symbols series.

July 29, 2003.

- Some L^AT_EX’ bugs have been fixed in `mathabx.dcl` with the help of some very kind users (Patrick Cousot, Hung N. Duong).
- The file `mathgrey.mf` is no longer used. That means that `mathu10` has no more grey characters. It seems that those characters are not compatible with some postscript or such translation (with `TeXtrace` for instance).
- The L^AT_EX style file `mathabx.sty` allows options which are `matha`, `mathb` and `mathx`. These options define which series will be used. If no option is given, the three series will be used. (The plainT_EX file `mathabx.tex` does not allow anything of this kind.)

October 23, 2003.

- The `\bar` and `\widebar` accents have changed of height (which is now smaller).
- Arrows have a wider breadth and a lighter head.
- A little work on digits has been done.
- Double brackets formerly named `\lbbbrack` and `\rbbbrack` are now named `\ldbbrack` and `\rdbbrack`, and they still have their curious aliases `\lsemantic` and `\rsemantic`.

2. List of every mathabx’ symbols

Specials (`matha/mathb`)

`\notsign` (rel), `\varnotsign` (rel), `(\cdot) \cdot \cdotp` (punct),

Usual binary operators (`matha`)

`(+)` `+` `+` (bin), `(-)` `-` `-` (bin), `(\times)` `\times` `\times` (bin), `(\div)` `\div` `\div` (bin), `(\cdot)` `\cdot` `\cdot` (bin), `(\circ)` `\circ` `\circ` (bin), `(*)` `*` `*` (bin), `(*)` `*` `\ast` (bin), `*` `\asterisk` (ord), `*`

$\backslash\text{coasterisk}$ (bin), $(\pm) \pm \backslash\text{pm}$ (bin), $(\mp) \mp \backslash\text{mp}$ (bin), $(\ltimes) \ltimes \backslash\text{ltimes}$ (bin), $(\rtimes) \rtimes \backslash\text{rtimes}$ (bin), $(\diamond) \diamond \backslash\text{diamond}$ (bin), $(\bullet) \bullet \backslash\text{bullet}$ (bin), $(\star) \star \backslash\text{star}$ (bin), $\star \backslash\text{varstar}$ (bin), $\backslash\text{sprod}$ (bin), $\backslash\text{scoprod}$ (bin),

Unusual binary operators (**mathb**)

$(\dot{+}) \dot{+} \backslash\text{dotplus}$ (bin), $(\dot{-}) \dot{-} \backslash\text{dotdiv}$ (bin), $(\dot{\times}) \dot{\times} \backslash\text{dottimes}$ (bin), $(\dot{-}) \dot{-} \backslash\text{divdot}$ (bin), $\cdot \backslash\text{udot}$ (bin), $(\square) \square \backslash\text{square}$ (bin), $\ast \backslash\text{Asterisk}$ (bin), $\ast \backslash\text{bigast}$ (op), $\ast \backslash\text{coAsterisk}$ (bin), $\ast \backslash\text{bigcoast}$ (op), $\dagger \backslash\text{circplus}$ (bin), $\oplus \backslash\text{pluscirc}$ (bin), $\ast \backslash\text{convolution}$ (bin), $(\ast) \ast \backslash\text{divideontimes}$ (bin), $\blacklozenge \backslash\text{blackdiamond}$ (bin), $\blacksquare \backslash\text{sqbullet}$ (bin), $(\bigstar) \bigstar \backslash\text{bigstar}$ (bin), $\bigstar \backslash\text{bigvarstar}$ (bin),

Usual relations (**matha**)

$(=) = \text{rel}$, $(\equiv) \equiv \backslash\text{equiv}$ (rel), $(\sim) \sim \backslash\text{sim}$ (rel), $(\approx) \approx \backslash\text{approx}$ (rel), $(\simeq) \simeq \backslash\text{simeq}$ (rel), $(\cong) \cong \backslash\text{cong}$ (rel), $(\asymp) \asymp \backslash\text{asympt}$ (rel), $(\mid) \mid \backslash\text{divides}$ (rel), $(\neq) \neq \backslash\text{neq}$ (rel), $(\not\equiv) \not\equiv \backslash\text{notequiv}$ (rel), $(\nsim) \nsim \backslash\text{nsim}$ (rel), $(\napprox) \napprox \backslash\text{napprox}$ (rel), $(\nsimeq) \nsimeq \backslash\text{nsimeq}$ (rel), $(\ncong) \ncong \backslash\text{ncong}$ (rel), $(\not\asymp) \not\asymp \backslash\text{notasympt}$ (rel), $(\nmid) \nmid \backslash\text{notdivides}$ (rel),

Unusual relations (**mathb**)

$(\dot{=}) \dot{=} \backslash\text{topdoteq}$ (rel), $(\bot) \bot \backslash\text{botdoteq}$ (rel), $(\dot{=}) \dot{=} \backslash\text{dotseq}$ (rel), $(\risingdotseq) \text{rel}$, $(\fallingdotseq) \text{rel}$, $(\coloneq) \text{rel}$, $(\eqcolon) \text{rel}$, $(\bumpeq) \text{rel}$, $(\eqbumped) \text{rel}$, $(\Bumpeq) \text{rel}$, $(\circeq) \text{rel}$, $(\eqcirc) \text{rel}$, $(\trianglelefteq) \text{rel}$, $(\corresponds) \text{rel}$,

Miscellaneous (**matha**)

$(\neg) \neg \backslash\text{neg}$ (ord), $(\ll) \ll \backslash\text{ll}$ (rel), $(\gg) \gg \backslash\text{gg}$ (rel), $\# \backslash\text{hash}$ (ord), $(\vdash) \vdash \backslash\text{vdash}$ (rel), $(\dashv) \dashv \backslash\text{dashv}$ (rel), $(\nvdash) \nvdash \backslash\text{nvDash}$ (rel), $(\dashv) \dashv \backslash\text{ndashv}$ (rel), $(\models) \models \backslash\text{Vdash}$ (rel), $(\dashv) \dashv \backslash\text{dashV}$ (rel), $(\nVdash) \nVdash \backslash\text{nVdash}$ (rel), $(\dashv) \dashv \backslash\text{ndashV}$ (rel), $(\circ) \circ \backslash\text{degree}$ (ord), $(\prime) \prime \backslash\text{prime}$ (ord), $(\prime\prime) \prime\prime \backslash\text{second}$ (ord), $(\prime\prime\prime) \prime\prime\prime \backslash\text{third}$ (ord), $(\prime\prime\prime\prime) \prime\prime\prime\prime \backslash\text{fourth}$ (ord), $(\flat) \flat \backslash\text{flat}$ (ord), $(\natural) \natural \backslash\text{natural}$ (ord), $(\sharp) \sharp \backslash\text{sharp}$ (ord), $(\infty) \infty \backslash\text{infty}$ (ord), $(\propto) \propto \backslash\text{propto}$ (ord), $(\dagger) \dagger \backslash\text{dagger}$ (ord), $(\ddagger) \ddagger \backslash\text{ddagger}$ (ord),

Miscellaneous (**mathb**)

$(\between) \between \text{rel}$, $(\smile) \smile \text{rel}$, $(\frown) \frown \text{rel}$, $\# \backslash\text{varhash}$ (ord), $(\leftthreetimes) \leftthreetimes \text{ord}$, $(\rightthreetimes) \rightthreetimes \text{ord}$, $(\pitchfork) \pitchfork \text{ord}$, $(\bowtie) \bowtie \text{rel}$, $\Vdash \text{rel}$, $\DashV \text{rel}$, $\nVDash \text{rel}$, $\nDashV \text{rel}$, $\VdashV \text{rel}$, $\dashVV \text{rel}$, $\nVdash \text{rel}$, $\ndashVv \text{rel}$, $(\therefore) \therefore \text{rel}$, $(\because) \because \text{rel}$, $\circ \backslash\text{ring. (???)}$, $\dot{\cdot} \backslash\text{dot. (???)}$, $\ddot{\cdot} \backslash\text{ddot. (???)}$, $\dddot{\cdot} \backslash\text{ddd. (???)}$, $\cdot \backslash\text{angle (ord)}$, $(\sphericalangle) \sphericalangle \backslash\text{sphericalangle (ord)}$,

Delimiters as symbols (**matha**)

$() ((\text{open}) , ()) \text{close}$, $[] [[\text{open}) , []] \text{close}$, $\backslash \backslash \backslash\text{setminus (ord)}$, $/ / / \text{ord}$, $| | | \text{ord}$, $\mid \mid \text{rel}$,

Delimiters as symbols (**mathb**)

$\lrcorner \lrcorner \text{open}$, $\rrcorner \rrcorner \text{close}$, $\ulcorner \ulcorner \text{open}$, $\urcorner \urcorner \text{close}$, $\llcorner \llcorner \text{open}$, $\lrcorner \lrcorner \text{close}$,

Astronomical symbols (`mathb`)

$\odot$ `\Sun` (ord), $\mercury$ `\Mercury` (ord), $\venus$ `\Venus` (ord), $\oplus$ `\Earth` (ord), $\mars$ `\Mars` (ord), $\jupiter$ `\Jupiter` (ord), $\saturn$ `\Saturn` (ord), $\uranus$ `\Uranus` (ord), $\neptune$ `\Neptune` (ord), $\pluto$ `\Pluto` (ord), $\varEarth$ `\varEarth` (ord), $\leftmoon$ `\leftmoon` (ord), $\rightmoon$ `\rightmoon` (ord), $\fullmoon$ `\fullmoon` (ord), $\newmoon$ `\newmoon` (ord), $\rip$ `\rip` (ord), $\aries$ `\Aries` (ord), τrus `\Taurus` (ord), $\gemini$ `\Gemini` (ord),

Letter like symbols (`matha`)

$\forall$ `\forall` (ord), $\complement$ `\complement` (ord), ∂ `\partial` (ord), ∂ `\partial` (ord), ∂ `\partial` (ord), $\exists$ `\exists` (ord), $\nexists$ `\nexists` (ord), $\Finv$ `\Finv` (ord), $\Game$ `\Game` (ord), $\emptyset$ `\emptyset` (ord), $\diameter$ `\diameter` (ord), $\top$ `\top` (ord), $\bot$ `\bot` (ord), $\perp$ `\perp` (rel), $\nottop$ `\nottop` (ord), $\notbot$ `\notbot` (ord), $\notperp$ `\notperp` (rel), $\curlywedge$ `\curlywedge` (bin), $\curlyvee$ `\curlyvee` (bin), $\in$ `\in` (rel), $\owns$ `\owns` (rel), $\notin$ `\notin` (rel), $\notowner$ `\notowner` (rel), $\varnotin$ `\varnotin` (rel), $\varnotowner$ `\varnotowner` (rel), $\bar{\in}$ `\bar{\in}` (rel), $\ownsbar$ `\ownsbar` (rel), $\cap$ `\cap` (bin), $\cup$ `\cup` (bin), $\uplus$ `\uplus` (bin), $\sqcap$ `\sqcap` (bin), $\sqcup$ `\sqcup` (bin), $\squplus$ `\squplus` (bin), $\wedge$ `\wedge` (bin), $\vee$ `\vee` (bin),

Letter like symbols (`mathb`)

$\bar{\wedge}$ `\bar{\wedge}` (bin), $\bar{\vee}$ `\bar{\vee}` (bin), $\bar{\bar{\wedge}}$ `\bar{\bar{\wedge}}` (bin), $\bar{\vee}$ `\bar{\vee}` (bin), $\bar{\cap}$ `\bar{\cap}` (bin), $\bar{\cup}$ `\bar{\cup}` (bin), $\bar{\sqcap}$ `\bar{\sqcap}` (bin), $\bar{\sqcup}$ `\bar{\sqcup}` (bin),

Subset's and superset's signs (`matha`)

$\subset$ `\subset` (rel), $\supset$ `\supset` (rel), $\nsubset$ `\nsubset` (rel), $\nsupset$ `\nsupset` (rel), $\subseteq$ `\subseteq` (rel), $\supseteq$ `\supseteq` (rel), $\nsubseteq$ `\nsubseteq` (rel), $\nsupseteq$ `\nsupseteq` (rel), $\subsetneq$ `\subsetneq` (rel), $\supsetneq$ `\supsetneq` (rel), $\varsubsetneq$ `\varsubsetneq` (rel), $\varsupsetneq$ `\varsupsetneq` (rel), $\subseteqeq$ `\subseteqeq` (rel), $\supseteqeq$ `\supseteqeq` (rel), $\nsubseteqeq$ `\nsubseteqeq` (rel), $\nsupseteqeq$ `\nsupseteqeq` (rel), $\subsetneqq$ `\subsetneqq` (rel), $\supsetneqq$ `\supsetneqq` (rel), $\varsubsetneqq$ `\varsubsetneqq` (rel), $\varsupsetneqq$ `\varsupsetneqq` (rel), $\Subset$ `\Subset` (rel), $\Supset$ `\Supset` (rel), $\nSubset$ `\nSubset` (rel), $\nSupset$ `\nSupset` (rel),

Square subset's and superset's signs (`mathb`)

$\sqsubset$ `\sqsubset` (rel), $\sqsupset$ `\sqsupset` (rel), $\n\sqsubset$ `\n\sqsubset` (rel), $\n\sqsupset$ `\n\sqsupset` (rel), $\sqsubseteq$ `\sqsubseteq` (rel), $\sqsupseteq$ `\sqsupseteq` (rel), $\n\sqsubseteq$ `\n\sqsubseteq` (rel), $\n\sqsupseteq$ `\n\sqsupseteq` (rel), $\sqsubsetneq$ `\sqsubsetneq` (rel), $\sqsupsetneq$ `\sqsupsetneq` (rel), $\var\sqsubsetneq$ `\var\sqsubsetneq` (rel), $\var\sqsupsetneq$ `\var\sqsupsetneq` (rel), $\sqsubseteqeq$ `\sqsubseteqeq` (rel), $\sqsupseteqeq$ `\sqsupseteqeq` (rel), $\n\sqsubseteqeq$ `\n\sqsubseteqeq` (rel), $\n\sqsupseteqeq$ `\n\sqsupseteqeq` (rel), $\sqsubsetneqq$ `\sqsubsetneqq` (rel), $\sqsupsetneqq$ `\sqsupsetneqq` (rel), $\var\sqsubsetneqq$ `\var\sqsubsetneqq` (rel), $\var\sqsupsetneqq$ `\var\sqsupsetneqq` (rel), $\sqSubset$ `\sqSubset` (rel), $\sqSupset$ `\sqSupset` (rel), $\n\sqSubset$ `\n\sqSubset` (rel), $\n\sqSupset$ `\n\sqSupset` (rel),

Triangles as relations (`matha`)

$\triangleleft$ `\triangleleft` (bin), $\vartriangleleft$ `\vartriangleleft` (rel), $\triangleright$ `\triangleright` (bin), $\vartriangleright$ `\vartriangleright` (rel), $\ntriangleleft$ `\ntriangleleft` (rel), $\ntriangleright$ `\ntriangleright` (rel), $\trianglelefteq$ `\trianglelefteq` (rel), $\trianglerighteq$ `\trianglerighteq` (rel), $\ntrianglelefteq$ `\ntrianglelefteq` (rel), $\ntrianglerighteq$ `\ntrianglerighteq` (rel),

`\bigboxcoasterisk (op)`, `\bigboxleft (op)`, `\bigboxright (op)`, `\bigboxtop (op)`, `\bigboxbot (op)`, `\bigboxvoid (op)`, `\bigboxslash (op)`, `\bigboxbackslash (op)`, `\bigboxtriangleup (op)`,

Delimiters (`matha/mathx`)

`( )` `( ( (???), ) )` `) ((???), ([[(???),]] (???), { } \lbrace (open), { } \rbrace (close), [\lbrack (open),] \rbrack (close), () \langle \langle (open), () \rangle \rangle (close), \backslash \backslash \backslash (ord), / / / (???), | \vert (ord), | | | (???), || \Vert (ord), ||| \vvert (ord), \uparrow \uparrow \uparrow (rel), \downarrow \downarrow \downarrow (rel), \updownarrow \updownarrow (rel), \Uparrow \Uparrow (rel), \Downarrow \Downarrow (rel), \Updownarrow \Updownarrow (rel),`

Delimiters (`mathb/mathx`)

`( )` `[ \lgroup (open), ] \rgroup (close), ( )` `[ \lceil (open), ] \rceil (close), ( )` `[ \lfloor (open), ] \rfloor (close), | \thickvert (ord),`

Delimiters (`mathx/mathx`)

`\lfilet (open)`, `\rfilet (close)`,

Pieces for over-under-braces and such (`mathx`)

`\braced (ord)`, `\bracem (ord)`, `\bracer (ord)`, `\bracex (ord)`, `\bracelu (ord)`, `\bracemu (ord)`, `\braceru (ord)`, `\bracexu (ord)`,

Extensible accents (`mathx`)

`\widehat. (???)`, `\widecheck. (???)`, `\widetilde. (???)`, `\widebar. (???)`, `\widearrow. (???)`, `\wideparen. (???)`, `\sqrt. (???)`,

3. Use with plain $\text{\TeX}$

The basic input file is `mathabx.tex`. It requires `mathabx.dcl` which is common to plain $\text{\TeX}$ and $\text{\LaTeX}$. So one should type

```
\input mathabx.tex
```

at the beginning of his (her) plain $\text{\TeX}$ document. This sets up all the symbols previously described and defines 3 new families of mathematical symbols whose numbers are `\mathafam`, `\mathbfam` and `\mathxfam`. Pointsizes are 10 pt, *i.e.*, `textstyle` is 10 pt, `scriptstyle` is 7 pt and `scriptscriptstyle` is 5 pt for `\mathafam` and `\mathbfam` families. For `\mathxfam` the three styles correspond to a pointsize equal to 10 pt as for `cmex` in plain $\text{\TeX}$. Changing pointsizes is easy since any plain $\text{\TeX}$ user know how to do so (one can also look into `mathabx.tex` to make sure).

4. Use with $\text{\LaTeX}$

The basic package is `mathabx.sty`. It requires `mathabx.dcl` which is common to plain $\text{\TeX}$ and $\text{\LaTeX}$. So one should type

```
\usepackage{mathabx}
```

in the preamble of his (her) $\text{\LaTeX}$ document. This sets up all the symbols previously described and defines 3 new families of mathematical symbols whose $\text{\LaTeX}$ names

are `matha`, `mathb` and `mathx` (according to L^AT_EX' font selection scheme). These families behave as expected with pointsize changes. The possible options of the `mathabx` package are `matha`, `mathb` and `mathx`. They allow to select which families would be actually defines. For instance

```
\usepackage[matha,mathx]{mathabx}
```

ignores the `mathb` family and load only `matha` and `mathx` families. Remember that no option means that the three families would be loaded. No individual symbol selection has been setted. If one wants to use only, say, a couple of symbols in the `mathabx` series, he (she) would have to it by him(her)self.

5. La commande `\not`

En plainT_EX ou en L^AT_EX, la commande `\not` ne fait qu'invoquer un caractère particulier (ligne inclinée) avec la valeur de relation. Ce caractère, qui est de longueur nulle, recouvre le caractère suivant d'autant mieux que son mode d'espacement est du type relation et que sa largeur a une certaine valeur (celle des signes `+` ou `=`). Autrement, le recouvrement peut être assez mauvais (en fait, inadapté).

Dans les séries présentées ici, certaines négations ont été définies. Il semblait alors souhaitable que la commande `\not` suivie par l'appel d'un caractère possédant sa négation propre ait pour résultat cette dernière. Il suffisait pour cela de définir `\not` comme une commande à un argument qui teste si cet argument est une commande dont la négation est définie (si celle-ci est `\xxx`, le test porte sur l'existence de `\notxxx` ou de `\nxxx`), auquel cas ce sera elle qui sera appliquée, sinon (si l'argument n'est pas une commande, par exemple si c'est un caractère, ou si la négation n'est pas définie) la méthode de superposition sera utilisée.

Le caractère de négation est appelé par `\notsign`, il appartient à la série `matha` et est droit. On peut y préférer une ligne inclinée présente dans la série `mathb` et nommée `\varnotsign`. Il suffit alors d'échanger les noms. C'est ce que fait la commande `\changenotsign` et ce de manière éventuellement locale. Ainsi on aura :

$$A \nmid B \quad \text{\code{\changenotsign}} \quad A \neq B$$

bien qu'on doive préférer sur cet exemple l'emploi de la commande `\neq` : $A \neq B$. Ci-dessous nous avons recours à la commande `\not` (sauf pour `\neq`) pour des relations dont la négation est définie :

$$a = b \neq c \equiv d \not\equiv e \sim f \not\sim g \approx h \not\approx i \simeq j \not\simeq k \cong l \not\cong m,$$

puis pour des relations (entre autres) dont la négation n'est pas définie :

$$a \doteq b \not\doteq c \doteq d \not\doteq e \doteq f \not\doteq g \doteq h \not\doteq i \doteq j \not\doteq k \text{\textit{Sl}} \not\text{\textit{Sl}} m,$$

où on se sera servi de `\changenotsign` à certains endroits. Il est à remarquer que l'espacement est perturbé de manière cohérente, c'est-à-dire de la même façon qu'il l'aurait été par le `\not` classique.

Nous avons aussi défini la commande `\varnot` de fonctionnement semblable à celui de l'instruction `\not` : `\varnotxxx` teste si `\varnotxxx` est défini et, si oui

exécute cette dernière, sinon applique `\varnotsign\xxx`. Nous reprenons la formule précédente avec cette commande :

$$a \doteq b \not\neq c \doteq d \neq e \div f \not\neq g \doteq h \not\neq i \doteq j \not\neq kSl \not\neq m,$$

où on ne voit aucune différence. En revanche,

$$a = b \neq c \equiv d \neq e \sim f \not\sim g \approx h \not\approx i \simeq j \not\simeq k \cong l \not\cong m$$

emploie dans ce cas uniquement la méthode de juxtaposition.

6. Numération maya

La présence de chiffres mayas dans ces séries n'est liée qu'à l'histoire du développement de celles-ci. Nous désirions au départ conserver quelques ressemblances avec les séries destinées au texte (caractères alphabétiques et numéraux). L'absence ou la rareté de possibilité de composer selon des numérations anciennes nous aura poussé à nous y intéresser un peu. Le résultat est illustré ci-dessous :

$$\begin{bmatrix} \vdots \\ \vdots \\ \cdot|| \end{bmatrix} + \begin{bmatrix} | \\ \cdot| \\ ||| \end{bmatrix} = \begin{bmatrix} \ddot{||} \\ \ddot{||} \\ \cdot| \end{bmatrix} \neq \textcircled{|||}.$$

Cette ligne aura été codée selon

```
\mayadelimiters([,])
```

```
\maya{1251}+\maya{2135}=\maya{3386}\neq\mayadigit{0}.
```

Maintenir les caractères et les commandes correspondantes dans cet ensemble est toujours sujet à questions.

7. La commande \prime et ses amies

Nous avons réintroduit les signes `\prime` multiples associés aux commandes `\prime`, `\second`, `\third` et `\fourth`. Une commande naturellement associée est `\degree` correspondant à un symbole semblable à celui appelé par `\circ`. Il est néanmoins différent car il doit être homogène à l'ensemble des symboles précédents (comparer 44° et 44°).

$$44^\circ + 36' + 89'' + 46''' + 99''''$$

La construction habituelle (*i.e.* $99''''''$) supporte une propriété de ligaturage sur les caractères correspondants. C'est ce que l'on voit ci-dessous :

$$44^\circ + 36' + 89'' + 46''' + 99''''', \quad \text{mais} \quad 99'''''' \quad \text{ou} \quad 99''''''''.$$

(Il faut y regarder de très près pour y voir ce qu'il faut voir...)

8. Essais divers

$$\begin{array}{ccccccc} G \triangleleft H \trianglelefteq A \triangleright B \triangleright C \\ |G| \ntriangleleft |H| \ntrianglelefteq |A| \ntriangleright |B| \ntriangleright |C| \\ \infty^{\infty\infty} \quad \infty^{\infty\infty} \quad \in^{\in\in\in} \quad \subset^{\subset\subset} \quad \subseteq^{\subseteq\subseteq} \quad <^{<<<} \end{array}$$

On a $\mu \ll \nu$, mais plus encore $\emptyset \ll \infty$. Rappelons que pour toute mesure μ sur E , $\mu(\emptyset) = 0$. D'autre part, $\sup \emptyset = 0$ et $\inf \emptyset = \infty$. Si $f \ll g$, ou de façon équivalente $f = o(g)$, alors $f = O(g)$. Lorsque $x \nmid |S| \nmid \nmid \infty$, on a $f(x) < \infty$.

$$\text{††††} <\leq\leq\leq >\geq\geq\geq$$

$$\frac{\partial f}{\partial x}(x) \simeq \frac{\partial f}{\partial x}(x) \quad \text{bbq\#\#bof bof}$$

$$\|T(h)f - f\| = \|T(h)f - f\|$$

$$A \cap B \cup C \uplus D \vee E \wedge F$$

$$A \sqcap B \sqcup C \boxplus D \searrow E \nearrow F \preceq G \overline{\preceq} F \prec H \wedge I$$

$$\dagger\dagger \ddagger\ddagger \ A^{\dagger\dagger} \cdot A^{\dagger\dagger} \ A * A * \{y\} \star * \sqrt{\sqrt{}}$$

$$\forall x \in y^\perp, \exists S \subseteq R, \exists x, (\exists x), \quad z \cap y, x \in y$$

$$f \mapsto g \longmapsto h \ f \hookrightarrow g \leftrightarrow h \ A \Longrightarrow B \Longleftarrow C \ a \leftrightsquigarrow b \rightsquigarrow c \rightsquigarrow d$$

$$\int \int \int_0^t f \circ g(x) \, dx = \int \int \int_0^t f \circ g(x) \, dx = \int \int \int_0^t f \circ g(x) \, dx$$

$$\int_0^t \oint_C f \circ g(x) \, dx = \oint_S f \circ g(x) \, dx$$

$$\prod_{i=0}^{i=n} \prod_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij} = \prod_{i=0}^{i=n} \prod_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij} = \prod_{i=0}^{i=n} \prod_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij} = \prod_{i=0}^{i=n} \prod_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij}$$

$$\prod_{i=0}^{i=n} \prod_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij} = \left(\prod_{i=0}^{i=n} \sum_{j=0}^{j=n} \prod_{k=0}^{k=n} \Gamma_k^{ij} \right) = \left[\sum_{i=0}^{i=n} \sum_{j=0}^{j=n} \sum_{k=0}^{k=n} \Gamma_k^{ij} \right] = \left[\sum_{i=0}^{i=n} \sum_{j=0}^{j=n} \sum_{k=0}^{k=n} \Gamma_k^{ij} \right]$$

$$\bigcup_{i=0}^{i=n} \bigcap_{j=0}^{j=n} \bigcup_{k=0}^{k=n} \Gamma_k^{ij} = \bigcup_{i=0}^{i=n} \bigvee_{j=0}^{j=n} \bigcup_{k=0}^{k=n} \Gamma_k^{ij} = \bigcup_{i=0}^{i=n} \bigwedge_{j=0}^{j=n} \bigcup_{k=0}^{k=n} \Gamma_k^{ij} = \bigvee_{i=0}^{i=n} \bigwedge_{j=0}^{j=n} \bigvee_{k=0}^{k=n} \Gamma_k^{ij}$$

Comme on le voit ci-dessus, il y a encore du boulot à faire pour équilibrer l'alignement de certains symboles.

9. Delimiters

The whole set of extensible delimiters is presented below. Some of those delimiters are quite close to *Computer Modern's* ones, for instance parentheses are almost the same. By now there are a few differences. Left and right groups are fully supported, i.e. every sizes exist. Moustaches are built in the font but not in a satisfactory way, so that the corresponding control sequences have not been written down. Some vertical lines are not supported, these are the ones that could be built with various extension moduli as in *Computer Modern*.

$$\begin{aligned} (X, X) &= [X, X] = \{X, X\} = \langle X^c, X^c \rangle \equiv [X^c, X^c] = \lceil X \rceil = \lfloor X \rfloor = \lceil X \rceil = \lfloor X \rfloor \\ (\mathsf{H} \mid \mathsf{O}) &= [\mathsf{H} \mid \mathsf{O}] = \{\mathsf{H} \mid \mathsf{O}\} = \langle \mathsf{H} \mid \mathsf{O} \rangle = \llbracket \mathsf{H} \mid \mathsf{O} \rrbracket = [\mathsf{H} \mid \mathsf{O}] \\ &= [\mathsf{H} \mid \mathsf{O}] = (\mathsf{H} \mid \mathsf{O}) = |\mathsf{H}| = \|\mathsf{H}\| = \|\mathsf{H}\| = \uparrow \mathsf{H} \downarrow \mathsf{H} = \uparrow \mathsf{H} \downarrow \mathsf{H} = \sqrt{} \\ (\mathsf{H} \mid \mathsf{O}) &= [\mathsf{H} \mid \mathsf{O}] = \{\mathsf{H} \mid \mathsf{O}\} = \langle \mathsf{H} \mid \mathsf{O} \rangle = \llbracket \mathsf{H} \mid \mathsf{O} \rrbracket = [\mathsf{H} \mid \mathsf{O}] \end{aligned}$$

10. Symboles astronomiques

The Earth $\oplus$ (or $\otimes$) is in rotation around the Sun $\odot$ like Mercury $\mercury$, Venus $\venus$, Mars $\mars$, Saturn $\saturn$, Jupiter $\jupiter$, Uranus $\uranus$, Neptune $\neptune$ and Pluto $\pluto$. But the Moon $\lunar$ is not.

La terre $\oplus$ (ou $\otimes$) est en rotation autour du soleil $\odot$ comme Mercure $\mercury$, Vénus $\venus$, Mars $\mars$, Saturne $\saturn$, Jupiter $\jupiter$, Uranus $\uranus$, Neptune $\neptune$ et Pluton $\pluto$ (in cm, one can have $\lunar$ quite easily). Mais la lune $\lunar$ ne l'est pas.

Nous ne dirons rien de φ ni de ψ qui ne sont que des symboles astrologiques et, dès lors, indignes de notre intérêt.

Bien évidemment, certains symboles possèdent un *alias* comme `\girl` et `\boy` : $\{(\mars, \mars), (\mars, \venus), (\venus, \mars), (\venus, \venus)\}$. C'est absolument fondamental pour un exercice sur le calcul de probabilités conditionnelles...

11. Unsupported



12. Mathabx font tables

13. Matha, major symbols series.

matha10	'0	'1	'2	'3	'4	'5	'6	'7	
'00x	+	−	×	÷	·	○	*	*	"0x
'01x	±	∓	⋈	⋈	◇	●	★	★	
'02x	=	≡	~	≈	≅	≅	≅		"1x
'03x	≠	≠	≠	≠	≠	≠	≠	≠	
'04x	¬	≪	≫	#	⊢	⊣	⊤	⊥	"2x
'05x	⊢	⊣	⊤	⊥	⊢	⊣	⊤	⊥	
'06x	○	!	!!	!!!	!!!!	!	!	!	"3x
'07x	∞	∞	†	‡					
'10x	∇	∇	∂	∂	∃	∄	∃	∃	"4x
'11x	∅	∅	⊤	⊥	⊤	⊥	⊤	⊥	
'12x	∈	∃	∉	∉	∉	∉	∉	∉	"5x
'13x	∩	∪	⊕	⊖	⊖	⊖	⊖	⊖	
'14x	⊕	⊖	⊗	⊕	⊙	⊙	⊗	⊗	"6x
'15x	⊕	⊕	⊕	⊕	○	○	○	⊕	
'16x	(	)	[	]	{	}	⌈	⌋	"7x
'17x	<	>	\	/					
'20x	⊂	⊃	⊄	⊄	⊆	⊇	⊄	⊄	"8x
'21x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	
'22x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	"9x
'23x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	
'24x	<	>	⊂	⊃	⊆	⊇	⊆	⊇	"Ax
'25x	≤	≥	⊂	⊃	⊆	⊇	⊆	⊇	
'26x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	"Bx
'27x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	
'30x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	"Cx
'31x	⊆	⊇	⊆	⊇	⊆	⊇	⊆	⊇	
'32x	←	→	↑	↓	↖	↗	↘	↙	"Dx
'33x	↔	↕	↔	↔	↔	↔	↔	↔	
'34x	←	→	←	→	↓	↓	↓	↓	"Ex
'35x	↔	↔	↔	↔					
'36x	↔	↔	↔	↔	↔	↔	↔	↔	"Fx
'37x	↔	=	⊂	⊃					
	"8	"9	"A	"B	"C	"D	"E	"F	

Mathb, minor symbols series.

mathb10	'0	'1	'2	'3	'4	'5	'6	'7	
'00x	$\dagger$	$\div$	$\dot{\times}$	$\div$	$\cdot$	$\square$	$*$	$*$	"0x
'01x	$\ddagger$	$\oplus$	$*$	$*$	$\blacklozenge$	$\blacksquare$	$\star$	$\star$	
'02x	$\dot{=}$	$\doteq$	$\dot{\div}$	$\doteq$	$\doteq$	$\doteq$	$\doteq$	$\doteq$	"1x
'03x	$\doteq$	$\doteq$	$\doteq$	$\doteq$	$\doteq$	$\doteq$			
'04x	$\bowtie$	$\smile$	$\frown$	$\#$	$\searrow$	$\swarrow$	$\pitchfork$	$\boxtimes$	"2x
'05x	$\Vdash$	$\Vdash$	$\nVdash$	$\nVdash$	$\Vdash$	$\Vdash$	$\nVdash$	$\nVdash$	
'06x	$\mathbb{U}$	$\cdot$	$:$	$\vdots$	$\vdots$	$\mid$	$\ddots$	$\ddots$	"3x
'07x	$\circ$	$\cdot$	$\ddot{\cdot}$	$\ddot{\cdot}$	$\ddot{\cdot}$	$\angle$	$\nless$	$\nless$	
'10x	$\odot$	$\oslash$	$\oslash$	$\oplus$	$\oslash$	$\nless$	$\oslash$	$\oslash$	"4x
'11x	Ψ	$\mathbb{P}$	$\oslash$	$\mathbb{C}$	$\mathbb{D}$	$\mathbb{O}$	$\bullet$	$\dagger$	
'12x	Υ	$\oslash$	Π						"5x
'13x	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	
'14x	$\boxplus$	$\boxplus$	$\boxtimes$	$\boxplus$	$\boxplus$	$\boxplus$	$\boxtimes$	$\boxtimes$	"6x
'15x	$\boxplus$	$\boxplus$	$\boxplus$	$\boxplus$	$\boxplus$	$\boxplus$	$\boxplus$	$\boxplus$	
'16x	$($	$)$	$[$	$]$	$[$	$]$	$[$	$]$	"7x
'17x	$\lceil$	$\rceil$	$\lfloor$	$\rfloor$	$\backslash$	$/$	$ $	$/$	
'20x	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	"8x
'21x	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	
'22x	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	$\sqsubset$	$\sqsupset$	$\nless$	$\nless$	"9x
'23x	$\triangle$	$\nless$	$\triangleleft$	$\triangleright$	$\blacktriangle$	$\blacktriangledown$	$\blacktriangleleft$	$\blacktriangleright$	
'24x	$\lessgtr$	$\gtrless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	"Ax
'25x	$\lessgtr$	$\gtrless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	
'26x	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	"Bx
'27x	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	
'30x	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	"Cx
'31x	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	$\nless$	
'32x	$\Leftrightarrow$	$\Rightarrow$	$\Uparrow$	$\Downarrow$	$\Leftrightarrow$	$\Leftrightarrow$	$\Leftrightarrow$	$\Leftrightarrow$	"Dx
'33x	$\Leftarrow$	$\Rightarrow$	$\Uparrow$	$\Downarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	
'34x	$\Leftarrow$	$\Rightarrow$	$\circ$	$\circ$	$/$	$/$			"Ex
'35x	$\Leftarrow$	$\Rightarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	
'36x	$\Leftarrow$	$\Rightarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	"Fx
'37x	$\Leftarrow$	$\Rightarrow$	$\Leftarrow$		$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	$\Leftarrow$	
	"8	"9	"A	"B	"C	"D	"E	"F	

Mathx, major extensible symbols series.

mathx10	'0	'1	'2	'3	'4	'5	'6	'7	
'00x	(	(	(	(	(	\			"0x
'01x	)	)	)	)	\	/			
'02x	[	[	[	[	[	[			"1x
'03x	]	]	]	]	]	]			
'04x	{	{	{	{	{	{	}	'	"2x
'05x	}	}	}	}	}	}	}	'	
'06x	[[	[[	[[	[[	[[	[[		⋈	"3x
'07x	]]	]]	]]	]]	]]	]]		⋈	
'10x	<	<	<	<	>	>	>	>	"4x
'11x	\	\	\	\	/	/	/	/	
'12x	[	[	[	[	]	]	]	]	"5x
'13x	[	[	[	[	]	]	]	]	
'14x	√	√	√	√	√	√		┐	"6x
'15x	ˆ	ˆ	ˆ	-	ˆ	ˆ	ˆ	-	
'16x	ˆ	ˆ	ˆ	-	ˆ	ˆ	(	)	"7x
'17x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	
'20x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	"8x
'21x	→	→	→	→	ˆ	ˆ	ˆ	ˆ	

'22x	+	×	℄	∩	∪	⊕	⊐	⊑	"9x
'23x	⊕	∧	∨	∧	∨	↑	↓		
'24x	+	×	℄	∩	∪	⊕	⊐	⊑	"Ax
'25x	⊕	∧	∨	∧	∨	↑	↓		
'26x	Σ	Π	Π	∫	∫∫	∫∫∫	ℳ	ℳ	"Bx
'27x	Σ	Π	Π	∫	∫∫	∫∫∫	ℳ	ℳ	
'30x	⊕	⊖	⊗	⊘	⊙	⊙	⊗	⊗	"Cx
'31x	⊕	⊕	⊕	⊕	○	○	○	△	
'32x	⊕	⊖	⊗	⊘	⊙	⊙	⊗	⊗	"Dx
'33x	⊕	⊕	⊕	⊕	□	□	□	△	
'34x	⊕	⊖	⊗	⊘	⊙	⊙	⊗	⊗	"Ex
'35x	⊕	⊕	⊕	⊕	○	○	○	△	
'36x	⊕	⊖	⊗	⊘	⊙	⊙	⊗	⊗	"Fx
'37x	⊕	⊕	⊕	⊕	□	□	□	△	
	"8	"9	"A	"B	"C	"D	"E	"F	

Mathux, unsupported extensible symbols series.

mathux10	'0	'1	'2	'3	'4	'5	'6	'7	
'10x	Σ	Π	Π	$\mathbb{C}$		$\cup$	$\cap$		"4x
'11x	$\triangle$	∇			$\top$	$\top$	$\perp$	$\perp$	
'12x	$\int$	$\oint$	$\oint$	$\oint$					"5x
'13x									
'20x	$\oplus$	$\oplus$	$\odot$	$\star$	$\star$	∇	$\triangleleft$	$\triangleleft$	"8x
'21x	$\ominus$	$\ominus$	$\ominus$	$\odot$	$\oplus$	$\otimes$	$\triangleleft$	$\triangleleft$	
'22x	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	"9x
'23x	Yin-Yang	Peace							
'24x	$\square$	$\square$	$\square$	$\star$	$\star$	∇	$\triangleleft$	$\triangleleft$	"Ax
'25x	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	
'26x	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	"Bx
'27x	Yin-Yang	Peace							
'30x	$\oplus$	$\oplus$	$\odot$	$\star$	$\star$	∇	$\triangleleft$	$\triangleleft$	"Cx
'31x	$\ominus$	$\ominus$	$\ominus$	$\odot$	$\oplus$	$\otimes$	$\triangleleft$	$\triangleleft$	
'32x	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	$\bullet$	"Dx
'33x	Yin-Yang	Peace							
'34x	$\square$	$\square$	$\square$	$\star$	$\star$	∇	$\triangleleft$	$\triangleleft$	"Ex
'35x	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	$\square$	
'36x	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	$\blacksquare$	"Fx
'37x	Yin-Yang	Peace							
	"8	"9	"A	"B	"C	"D	"E	"F	

Mathu, unsupported symbols series.

The series mathu have some features that may interest people: it contains the whole set of calligraphic characters of cmsy and also extends it. The first part of this extension is the latin lowercase letters, and also the punctuation which make it a quite complete OT1 font. This part of the extension is due to me. Hebrew characters have been converted to MetaFont, adapted and extended (dagesh sign) also by me, but the source is some commercial font. The pseudo-mathematical symbols which come next are just symbols that have been created beside regular series.

mathu10/cmsy10

$AA_{65} BB_{66} CC_{67} DD_{68} EE_{69} FF_{70} GG_{71} HH_{72} II_{73} JJ_{74} KK_{75} LL_{76} MM_{77} NN_{78}$
 $OO_{79} PP_{80} QQ_{81} RR_{82} SS_{83} TT_{84} UU_{85} VV_{86} WW_{87} XX_{88} YY_{89} ZZ_{90}$

cmsy10/cmml10

$AA_{65} BB_{66} CC_{67} DD_{68} EE_{69} FF_{70} GG_{71} HH_{72} II_{73} JJ_{74} KK_{75} LL_{76} MM_{77} NN_{78}$
 $OO_{79} PP_{80} QQ_{81} RR_{82} SS_{83} TT_{84} UU_{85} VV_{86} WW_{87} XX_{88} YY_{89} ZZ_{90}$

mathu10/cmml10

$AA_{65} BB_{66} CC_{67} DD_{68} EE_{69} FF_{70} GG_{71} HH_{72} II_{73} JJ_{74} KK_{75} LL_{76} MM_{77} NN_{78}$
 $OO_{79} PP_{80} QQ_{81} RR_{82} SS_{83} TT_{84} UU_{85} VV_{86} WW_{87} XX_{88} YY_{89} ZZ_{90}$

mathu10/cmml10

$aa_{97} bb_{98} cc_{99} dd_{100} ee_{101} ff_{102} gg_{103} hh_{104} ii_{105} jj_{106} kk_{107} ll_{108} mm_{109} nn_{110} oo_{111} pp_{112}$
 $qq_{113} rr_{114} ss_{115} tt_{116} uu_{117} vv_{118} ww_{119} xx_{120} yy_{121} zz_{122}$

mathu10	'0	'1	'2	'3	'4	'5	'6	'7	
'02x	ι	∫	`	'	˘		-	°	"1x
'03x	ς	β	æ	œ	ø				
'04x			”					,	"2x
'05x	(	)			,	-	.		
'06x	0	1	2	3	4	5	6	7	"3x
'07x	8	9	:	;					
'10x	@	A	B	C	D	E	F	G	"4x
'11x	H	I	J	K	L	M	N	O	
'12x	P	Q	R	S	T	U	V	W	"5x
'13x	X	Y	Z	[	“	]	^	.	
'14x	‘	a	b	c	d	e	f	g	"6x
'15x	h	i	j	k	l	m	n	o	
'16x	p	q	r	s	t	u	v	w	"7x
'17x	x	y	z	-	—	”	~	..	
'20x	א	ב	ג	ד	ה	ו	ז	ח	"8x
'21x	ט	י	ך	כ	ל	ם	מ	ן	
'22x	נ	ס	ע	ף	פ	ץ	צ	ק	"9x
'23x	ר	ש	ת	ז	ח	טו	טז	✱	

Gf~T`gJGOW]SLbDmZP]s]Ffdrjho^`XJjP[VdnSe]ho
 eMziPbUhj]DrLbMtg[MTimDYObtXC.FBQYrK.fFc`ygS^
 lJd^fAMkVi.MLYS`J`GGNBdrIfFPM``J`uBBRu`Wdd`R
 dLVvJKCVtX`VKPaxGWP`eMpYJghWoKGWxX.XE[GyO]bI
 uLTwUZpY]S]SSDeLVcP`^jlwfY`xVHqgbzWMsOKLVG`a
 SbonEuETQH`z`ohzQ`Vis]xc]YDC`pld`[xxDglFCOQ
 KgjG.JiXwjLi`HcFzxAr`ZEVtyLPRQTODMSniRzpnFcR
 dv`TkFOojAPMtSFVPWeyRC.FH.PHCqOFpXOXzZui]kjUZ
 gOlwb]BeR]SQVrKtFCHmmQslKR.FhweFKbZfhd`xEeHB
 Ggmbz]ZH`fo`WPEAkMQhhukavZuytu.AuFOLqtesKhM[
 `eKb]AQV`dOSdHsbf`TTvwqLiEeGkXnhKuGODktYcaC
 APsOfzKBvK.m.Ma`kUtvYjRTVLuvWxEdXk[cWOikGevJ
 SrRqDvuKFpN`z`Ny`aHg[kljR`qC.XkoRnevxvItpEF