Font Config Notes

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Contents

1 Text Font command

Later we call the axis name by "parameter", then we call a font has 6 parameters.

1.1 How to set font

```
-> code
```

-¿ code

```
\fontencoding{T1}\fontfamily{cmss}\fonts
eries{bx}\fontshape{it}\selectfont
-> Hello world.
```

-> Hello world.

There is a short hand command **\usefont**, equivalent to font set commands and a following selectfont command. An simple example as follows:

```
\usefont{T1}{cmss}{bx}{it}
-> Hello world.
```

-> Hello world.

1.2 check the attributes of current font

```
\fontsize {12pt} {12pt}
\usefont{T1}{cmr}{m}{sc}
\makeatletter
Encoding = \f@encoding\par
Family = \f@family\par
Series = \f@series\par
Shape = \f@shape\par
Font size = \f@size\par
Baseline skip = \f@baselineskip

\vskip2em
\hskip-.5em\begin{tabular}[t]{lcl}
math size & = & value(pt) \\[.5em]
Main  & = & \(\tf@size\)\\
`script' & = & \(\sf@size\)\\
`scriptscript' & = & \(\ssf@size\)
\end{tabular}
\makeatother
```

Encoding = T1
Family = cmr
Series = m
Shape = sc
Font size = 12
Baseline skip = 12.0pt

math size	=	value(pt)
Main	=	12
'script'	=	8
'scriptscript'	=	6

The last three are accessible only within a formula; outside of math they may contain arbitrary values.

1.3 set parameters

Some default parameter values are:

```
textrm = \rmdefault\par
textsf = \sfdefault\par
texttt = \ttdefault\par

\vskip1em
\textrm{Hello world.}\par
\textsf{Hello world.}\par
\texttt{Hello world.}
```

textrm = cmr
textsf = cmss
texttt = cmtt

Hello world.
Hello world.
Hello world.

What if we change it:

```
\renewcommand{\rmdefault}{ptm}
\renewcommand{\sfdefault}{phv}
\renewcommand{\ttdefault}{pcr}

textrm = \rmdefault\par
textsf = \sfdefault\par
texttt = \ttdefault\par

\vskip1em
\textrm{Hello world.}\par
\textsf{Hello world.}\par
\texttt{Hello world.}
```

textrm = ptm
textsf = phv
texttt = pcr

Hello world.
Hello world.
Hello world.

The other default parameters values are:

```
\encodingdefault\par
\familydefault\par
\seriesdefault\par
\shapedefault\par
\bfdefault\par
\mddefault\par
\itdefault\par
\sldefault\par
\scdefault\par
\sscdefault\par
\swdefault\par
\ulcdefault\par
\updefault
```

OT1
cmr
m
n
b
m
it
sl
sc
ssc
sw
ulc
up

1.4 Special font declaration commands

Unlike the above `\usefont`, there are some alternative commands to switch font:

- `\DeclareFixedFont`
- `\DeclareTextFontCommand`: use syntax like `<cmd>{ ... }`
- `\DeclareOldFontCommand`: use syntax like `{<cmd> ...}`

2 Math Font command

2.1 math alphabets

Math fonts called by `\mathsf{}`, `\mathbf{}` are called **math alphabets**(maybe called "math letters (font)" is better, in my opinion.), thus these math alphabet commands only affect:

- fonts used for letters
- symbols of type `\mathalpha`

```
% default math rm font
\[\mathrm{Hello world}\]

% change the default text rm font
\renewcommand{\rmdefault}{ptm}
\[\mathrm{Hello world}\]
```

$$\mathrm{Helloworld}$$

$$\mathrm{Helloworld}$$

2.2 math symbol fonts

Some symbols font are called **math symbol fonts**, like the symbol `\oplus`($\oplus$), `>, +`($>, +$), these fonts that contain these symbols are called **math symbol fonts**.

Symbol font	Description	Example
operators	symbols from `\mathrm`	$[+]$
letters	symbols from `\mathnormal`	$<< \star >>$
symbols	most LaTeX symbols	$\leq * \geq$
largesymbols	large symbols	$\sum \prod \int$

Like text font, Math fonts have the same 5 attributes, But don't have commands to change the attributes individually. To change these attributes, you should use **math version**, and this command change the whole attributes. There are 2 predefined math version:

- normal: default, use `\unboldmath` to select "normal" math version.
- bold : use command `\boldmath` to select "bold" math version.

Or use command `\mathversion{<version>}` to switch math version.

```
\[ a^2 + b^2 = c^2 \]

\boldmath
\[ a^2 + b^2 = c^2 \]

\unboldmath
\[ a^2 + b^2 = c^2 \]
```

$$a^2 + b^2 = c^2$$

$$\boldsymbol{a^2 + b^2 = c^2}$$

$$a^2 + b^2 = c^2$$

Use the External font attributes for math fonts in Text context. We use a font family named "Computer Modern Math Symbols(cmsy)", The encoding is "OMS".

```
\DeclareFixedFont{\textMathSwitch}{OMS}{
cmsy}{m}{n}{10}
\textMathSwitch ABCXYZ

\DeclareFixedFont{\newtextMathSwitch}{OM
S}{cmsy}{m}{n}{14}
\newtextMathSwitch ABCXYZ
```

$\mathcal{ABCXYZ}$
$\mathcal{ABCXYZ}$

There are **no commands** for selecting symbol fonts. Instead, these are selected **indirectly** through symbol commands like `\oplus`.

2.3 Declaring math versions

We can declare math font (cmd) version by `\DeclareMathVersion`. Unlike the text font command that can change a single parameter value, the math version command need to change the whole parameters based on the math version declared so far.

2.4 Declaring math alphabets

An example to change the default math alphabets font:

```
% this declaration should be in preamble
% \DeclareMathAlphabet{\mathbf}{OT1}{cmr
}{m}{sc}
\[ \mathbf{Hello World} \]
```

HELLOWORLD

You can use `\SetMathAlphabet` to set math alphabet for a specific math version or **fixed the defined nowhere error caused by no shape**.

2.5 Declaring symbol fonts

Just copy some example from the the doc: For example, the following sets up the first four standard math symbol fonts:

```
\DeclareSymbolFont{operators}{OT1}{cmr}{m}{n}
\DeclareSymbolFont{letters}{OML}{cmm}{m}{it}
\DeclareSymbolFont{symbols}{OMS}{cmsy}{m}{n}
\DeclareSymbolFont{largesymbols}{OMX}{cmex}{m}{n}
```

You can declare a new symbols font like the following (refer to TeX-SE:Difficulty in using slot to declare math symbol):

```
\@ifundefined{mathbb}{%
  \DeclareSymbolFontAlphabet{\mathbb}{AMSb}%
}{}
\DeclareSymbolFont{AMSb}{U}{msb}{m}{n}
\DeclareMathAlphabet{\mathbb}{U}{msb}{m}{n}
```

Then you can define your own math symbols using the new symbols font.

2.6 Declaring math symbols

This is the most interesting part to me. Let's see how it works:

- `\DeclareMathSymbol {⟨symbol⟩} {⟨type⟩} {⟨sym-font⟩} {⟨slot⟩}`

  The `⟨symbol⟩` can be:

  - a single character, like `>`
  - a control sequence, like `\sum`

  The `⟨type⟩` is as follows:

Type	*Meaning*	*Example*
0 or `\mathord`	Ordinary	α
1 or `\mathop`	Large operator	$\sum$
2 or `\mathbin`	Binary operation	$\times$
3 or `\mathrel`	Relation	$\leq$
4 or `\mathopen`	Opening	$\langle$
5 or `\mathclose`	Closing	$\rangle$
6 or `\mathpunct`	Punctuation	;
7 or `\mathalpha`	Alphabet character	A

Some inner symbols definition:

```
\DeclareMathSymbol{\alpha}{0}{letters}{"0B}
\DeclareMathSymbol{\lessdot}{\mathbin}{AMSb}{"0C}
\DeclareMathSymbol{\alphld}{\mathalpha}{AMSb}{"0C}
```

What is `AMSb` symbols font ? In the previous, there are only 4 symbol fonts: operators, letters, symbols, largesymbols. And what is `<slot>` ? Is this something like glyph index ? And how to extract slot from the font tabel ? There is an original definition for `\nsubseteq` from document "User's Guide to AMSFonts Version 2.2d":

```
% can be only used in preamble
% \usepackage{amsfonts}
% \DeclareMathSymbol{\nsubseteq}{\mathrel}{AMSb}{"2A}
\[ \nsubseteq \]
```

$$\nsubseteq$$

You can setup your own math symbols font, do not forget to load package `amsfonts`(and `amssymb` is superset of the `amsfonts` package,) in your preamble.

```
% can be only used in preamble
% \usepackage{amsfonts}
% \DeclareMathSymbol{\myHbar}{\mathrel}{AMSb}{"7E}
\[ \myHbar \]

% \DeclareMathSymbol{\myDoublecup}{\mathbin}{AMSa}{"64}
\[ \myDoublecup \]
```

$$\hbar$$

$$\Cup$$

The "slot" can be found in document "User's Guide to AMSFonts Version 2.2d". The tables for symbols font look like:

We just need to find the last 2 digits of the index as a slot number in `\DeclareMathSymbol`, this is so easy. The document has already said the digits meaning in these table:

- First digit identifies font: '1-AMSa', '2-AMSb'
- Second digit identifies class: '0-mathord', '2-mathbin', '3-mathrel'
- Third and fourth digits identify **(hex) location** in font

Thus it is true that the last 2 digits of the index are the slot number in the font table. The fisrt digit already used when we declare the symbol font. Such as the 'AMSb'(the first digit is 2) in `\myHbar` definition; The 'AMSa'(the fisrt digit is 1), the '`\mathbin`'(the Second digit is 2) in `\mysquigarrow` definition.

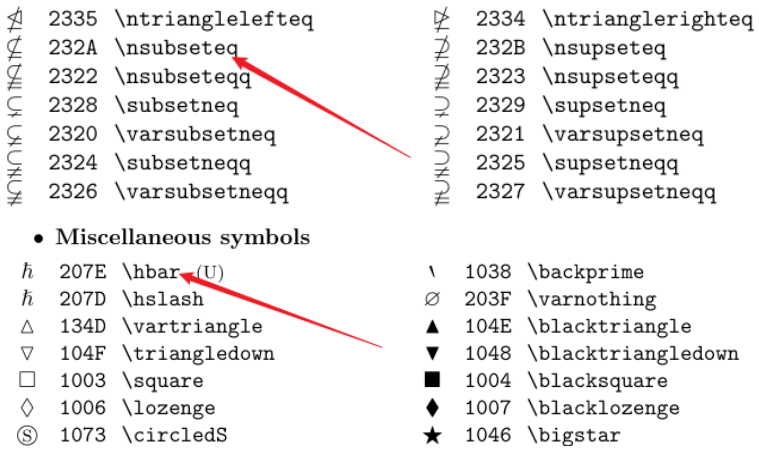

Figure 1: symbols font table in AMS fonts

2.7 Declaring math sizes

2.8 Mind map for math font

3 Font table

3.1 introduction

- How to find your symbols for a given font, such as the default "cmr10"?
- How to see all avaliable symbols(glyphs) for a given font ?
- What are `\char, \chardef` doing for us?

3.2 see font table

We first show how to see all the avaliable symbols for a given font, such as the default "cmr10". There are 2 ways:

- use package `fonttable` in preamble
- type `pdftex testfont` in shell

The first method use example:

```
\documentclass{article}
\usepackage{fonttable}
\begin{document}
\fonttable{cmr10}
\end{document}
```

Then you will get a font table like Table 1:

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	Γ 0	Δ 1	Θ 2	Λ 3	Ξ 4	Π 5	Σ 6	Υ 7	″0x
´01x	Φ 8	Ψ 9	Ω 10	ff 11	fi 12	fl 13	ffi 14	ffl 15	
´02x	ı 16	ȷ 17	` 18	´ 19	ˇ 20	˘ 21	¯ 22	° 23	″1x
´03x	¸ 24	ß 25	æ 26	œ 27	ø 28	Æ 29	Œ 30	Ø 31	
´04x	˝ 32	! 33	” 34	# 35	$ 36	% 37	& 38	’ 39	″2x
´05x	(40	) 41	* 42	+ 43	, 44	- 45	. 46	/ 47	
´06x	0 48	1 49	2 50	3 51	4 52	5 53	6 54	7 55	″3x
´07x	8 56	9 57	: 58	; 59	¡ 60	= 61	¿ 62	? 63	
´10x	@ 64	A 65	B 66	C 67	D 68	E 69	F 70	G 71	″4x
´11x	H 72	I 73	J 74	K 75	L 76	M 77	N 78	O 79	
´12x	P 80	Q 81	R 82	S 83	T 84	U 85	V 86	W 87	″5x
´13x	X 88	Y 89	Z 90	[91	“ 92	] 93	ˆ 94	˙ 95	
´14x	‘ 96	a 97	b 98	c 99	d 100	e 101	f 102	g 103	″6x
´15x	h 104	i 105	j 106	k 107	l 108	m 109	n 110	o 111	
´16x	p 112	q 113	r 114	s 115	t 116	u 117	v 118	w 119	″7x
´17x	x 120	y 121	z 122	– 123	— 124	˝ 125	˜ 126	¨ 127	
	″8	″9	″A	″B	″C	″D	″E	″F	

Table 1: Computer modern roman 10 font table

Use this package, the **slot**(decimal) is automatically shown in the table.

The second method is type the font table in shell, the red content is what you need to type:

```
$ pdftex testfont
This is pdfTeX, Version 3.141592653-2.6-1.40.26 (TeX Live 2024) (preloaded format=pdftex)
  restricted \write18 enabled.
entering extended mode
(c:/texlive/2024/texmf-dist/tex/plain/knuth-lib/testfont.tex

Name of the font to test = cmsy10
Now type a test command (\help for help):)
*\table

*\bye
[1{c:/texlive/2024/texmf-var/fonts/map/pdftex/updmap/pdftex.map}]<c:/texlive/20
24/texmf-dist/fonts/type1/public/amsfonts/cm/cmr10.pfb><c:/texlive/2024/texmf-d
ist/fonts/type1/public/amsfonts/cm/cmr7.pfb><c:/texlive/2024/texmf-dist/fonts/t
ype1/public/amsfonts/cm/cmsy10.pfb><c:/texlive/2024/texmf-dist/fonts/type1/publ
ic/amsfonts/cm/cmti10.pfb><c:/texlive/2024/texmf-dist/fonts/type1/public/amsfon
ts/cm/cmtt10.pfb>
Output written on testfont.pdf (1 page, 72741 bytes).
Transcript written on testfont.log.
```

You will get something like table 2:

Whilst, there is no slot number in the table this time. Another font table(cmex) for Large symbol font:

	′0	′1	′2	′3	′4	′5	′6	′7	
′00x	−	·	×	∗	÷	⋄	±	∓	″0x
′01x	⊕	⊖	⊗	⊘	⊙	◯	∘	•	
′02x	≍	≡	⊆	⊇	≤	≥	≼	≽	″1x
′03x	∼	≈	⊂	⊃	≪	≫	≺	≻	
′04x	←	→	↑	↓	↔	↗	↘	≃	″2x
′05x	⇐	⇒	⇑	⇓	⇔	↖	↙	∝	
′06x	′	∞	∈	∋	△	▽	/	◦	″3x
′07x	∀	∃	¬	∅	ℜ	ℑ	⊤	⊥	
′10x	ℵ	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	⊢	⊣	⌊	⌋	⌈	⌉	{	}	″6x
′15x	⟨	⟩	|	‖	↕	⇕	\	≀	
′16x	√	∐	∇	∫	⊔	⊓	⊑	⊒	″7x
′17x	§	†	‡	¶	♣	♢	♡	♠	
	″8	″9	″A	″B	″C	″D	″E	″F	

Table 2: cmsy10 font table

3.3 `\char` command

How to type the symbols(glyphs) in the above font table? There are 2 "coordinate" systems:

- left and upper: the **octal** number coordinate
- right and lower: the **hex** number coordinate

For example, if we want to type the **dollar** character: "$", there are two ways:

```
% octal
Octal number: \char'044

% hex
Hex number: \char"24\char"2C

% slot
Slot(decimal) number: \char36

% \chardef
\chardef\mydollar=36
Chardef Command: \mydollar
```

Octal number: $
Hex number: $,
Slot(decimal) number: $
Chardef Command: $

The `'x'` in `'04x` means the 'x' coordinate, in this case, it is ''4'. For hex coordinate, this is a little different. Each hex row consists of 2 rows, in this case, the first row is from '`"20`' to '`"27`', the second row is from '`"28`' to '`"2f`'. In both case we have

$$044\text{octal} = 24\text{hex} = 36\text{decimal}$$

Remark: the `'` represents the octal number, and the `"` represents the hex number, and `` ` `` represents the decimal(slot) number.

3.4 `\mathcal` for lowercase

If you type lowercase letters in command `\mathcal`, you will get a wrong result, only upper case letters, like `\mathcal{A}` will get the right script font.

	′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	↑	↓	⏜	⏝	⏟	⏟	⇑	⇓	
	″8	″9	″A	″B	″C	″D	″E	″F	

Table 3: cmsy10 font table

This for that `\mathcal{<char>}` will use the slot number in the font table; Take letter 'A' for example, the slot number is "65", In the font table, slot number "65(decimal)" is just the script style 'A'. Whilst, the slot number for 'a' is "97('141 in octal)", and the result is a orthogonal symbol.

```
% \usepackage{amsmath}
\begin{align}
  & \mathcal{A} \\
  & \mathcal{a}
\end{align}
```

$$\mathcal{A} \tag{1}$$
$$\dashv \tag{2}$$