The ShorTeX package

Trevor Campbell, Jonathan Huggins, and Jeff Negrea

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Abstract

The purpose of the ShorTeX (meta)package is to make the process of typesetting typical mathematical documents in LaTeX more efficient, and the resulting code easier to read. It achieves this by (1) providing an extensive, internally consistent, and easy to learn set of macro shorthands and custom commands, and (2) incorporating a set of packages that are dedicated to reducing manual coding effort.

Contents

1 Usage and package options

Include ShorTeX by adding `\usepackage{shortex}` to the preamble of your document. ShorTeX will include and configure many common packages for you (e.g., `graphicx, subcaption, hyperref, algorithm, algpseudocode, amsmath`, among others), so you do not need to explicitly include and set these up yourself. If you are writing a document that must use a specific style file (e.g., for a conference or journal) that itself includes some of these packages, we recommend editing those style files to remove the package imports.

The ShorTeX package has a few options:

`manualnumbering` Do not include `autonum.sty`. This disables automatic equation numbering.

`blackhypersetup` Switch hyperlinks, citations, references, etc. to be typeset in black font. The default is dark blue.

You must compile your document 4 times when using ShorTeX to ensure that equation numbers and references update properly.

2 Packages included in ShorTeX

2.1 Internal packages

The following packages provide features that are used internally in ShorTeX for macro definitions etc.

xifthen, xstring, xspace, xargs asdf

2.2 Typical packages

We include a set of typical packages to avoid the problem of having to remember precisely what order to import each one, which options, compatibility, etc

It is worth noting that we did not include a standard bibliography package in ShorTeX (e.g., `natbib.sty`). This is because...

mathrsfs,dsfont,amsmath,amssymb,amsthm,bm,bbm,amsfonts,mathtools,thmtools asdf

hyperref asdf

color asdf

algorithm, algpseudocode asdf

graphicx asdf

2.3 Improvement packages

cleveref Typically to use a reference in LaTeX, you have to write the name of the type of reference yourself. For example, if you want to reference a figure, you would have to write something like:

```
In Figure \ref{fig:first}, you can see...
```

Or for multiple figures, you might use:

```
Figures \ref{fig:first}, \ref{fig:second},
and \ref{fig:third} show that...
```

The `cleveref` package simplifies this process significantly. Use the `\cref` command to automatically typeset the names of the objects you're referencing (including properly handling multiple references). The above two examples become

```
In \cref{fig:first}, you can see...
```

and

```
\cref{fig:first,fig:second,fig:third} show that...
```

This works for many different reference types (Figure, Algorithm, Equation, Table, etc), and can be extended if needed. See the `cleveref` documentation at https://ctan.org/pkg/cleveref?lang=en and the homepage at https://www.dr-qubit.org/cleveref.html for more information.

autonum Typically when you typeset equations, you have to choose between `$...$`, `$$...$$`, `\begin{align}...\end{align}`, `\begin{aligned}...\end{aligned}`, `\begin{equation}...\end{equation}`, not to mention starred versions of those environments and `\nonumber`/`\notag` commands, depending on whether/where you want equation numbers, display or in-text math, etc. This leads to verbose, inconsistent code.

The `autonum` package automatically decides which equations to provide numbers based on *which equations you reference*. So when using ShorTeX, you only need two commands for math mode: single dollar signs `$...$` for inline math, and `align` environments (redefined in ShorTeX to be `\[...\]`) for display math.[1]

For example, if you create the following display math,

[1] Note that there are minor differences between how `align` and `equation` display equations. But after 10+ years of using LaTeX, I have not ever encountered a case where it mattered much. That being said, ShorTeX does not *disable* any functionality, so you can use the usual environments anywhere you feel it is necessary.

```
\[
   a+b = c \label{eq:the_equation}
\]
```

then if you use the command `\cref{eq:the_equation}` somewhere in the document, that equation will automatically be assigned a number. If not, it won't get a number. See the `autonum` package documentation https://ctan.org/pkg/autonum?lang=en for more information.

nicefrac asdf

crossreftools asdf

multirow asdf

wrapfig asdf

caption,subcaption asdf

microtype asdf

booktabs asdf

import,subfiles asdf

url asdf

3 Shorthands for existing commands

3.1 Environments

LaTeX documents often includes a lot of verbose code related to creating environments (`\begin{blah}...\end{blah}`). ShorTeX provides a set of shortened macros for common environments. Note that all theorem-like environments (theorem, lemma, proposition, etc.) are numbered by default; unnumbered versions can be obtained by appending a `u`. For example, `\bthmu...\ethmu` creates an unnumbered theorem environment, while `\blemu...\elemu` creates an unnumbered lemma environment.

Environment	Syntax
abstract	`\babs...\eabs`
itemize	`\bitems...\eitems`
enumerate	`\benum...\eenum`
description	`\bdesc...\edesc`
algorithm	`\balg...\ealg`
algorithmic	`\balgc...\ealgc`
table	`\btab...\etab`
subtable	`\bsubtab...\esubtab`
tabular	`\btabr...\etabr`
figure	`\bfig...\efig`
figure*	`\bfigs...\efigs`
subfigure	`\bsubfig...\esubfig`
center	`\bcent...\ecent`
align	`\[...\]`
inline math	`$...$`
Note: These are numbered theorem-like environments. For unnumbered, append a `u`*: e.g.,* `bthmu...ethmu`.	
theorem	`\bthm...\ethm`
lemma	`\blem...\elem`
proposition	`\bprop...\eprop`
corollary	`\bcor...\ecor`
conjecture	`\bconj...\econj`
definition	`\bdef...\edef`
assumption	`\bassump...\eassump`
example	`\bexa...\eexa`
remark	`\brmk...\ermk`
fact	`\bfact...\efact`
exercise	`\bexer...\eexer`
proof	`\bprf...\eprf`
proofof	`\bprfof{\cref{theorem_label}}...\eprfof`
matrix	`\bmat...\emat`
bmatrix	`\bbmat...\ebmat`
pmatrix	`\pbmat...\epmat`

3.2 Delimiters

Mathematics in LaTeX often includes quite a few delimiters (parentheses, brackets, curly brackets, etc.). A very common usage of these involves the `\left...\right` commands for automatic sizing. One can also use `\bigl...\bigr`, `\Bigl...\Bigr`, `\biggl...\biggr`, `\Biggl...\Biggr` to control sizing manually. ShorTeX creates shorthands for these.

Description	Syntax
automatic	`\lt...\rt`
big	`\lb...\rb`
Big	`\lB...\rB`
bigg	`\lbg...\rbg`
Bigg	`\lBg...\rBg`

These can be applied to all the usual delimiter characters. The following tables demonstrate usage for automatically sized delimiters.

Description	Example	Text style	Display style
parentheses	`\lt(\frac{x}{y}\rt)`	$\left(\frac{x}{y}\right)$	$\left(\frac{x}{y}\right)$
curly brackets	`\lt\{\frac{x}{y}\rt\}`	$\left\{\frac{x}{y}\right\}$	$\left\{\frac{x}{y}\right\}$
square brackets	`\lt[frac{x}{y}\rt]`	$\left[\frac{x}{y}\right]$	$\left[\frac{x}{y}\right]$
pipes	`\lt|frac{x}{y}\rt|`	$\left\|\frac{x}{y}\right\|$	$\left\|\frac{x}{y}\right\|$
double pipes	`\lt\\|frac{x}{y}\rt\\|`	$\left\|\frac{x}{y}\right\|$	$\left\|\frac{x}{y}\right\|$
angle brackets	`\lt<frac{x}{y}\rt>`	$\left\langle\frac{x}{y}\right\rangle$	$\left\langle\frac{x}{y}\right\rangle$

3.3 Font styles and accents

Applying accents (e.g., hats $\widehat{a}$, tildes $\widetilde{a}$, bars $\overline{a}$) and changing fonts (e.g., double-stroke $\mathbb{A}$, caligraphic $\mathcal{A}$, and bold $\boldsymbol{A}$) is quite cumbersome in standard LaTeX. For example, the code to make a tilde caligraphic A, $\widetilde{\mathcal{A}}$ is `\widetilde{\mathcal{A}}`. By itself that code is not too bad, but many such characters in a large mathematical expression results in unreadable code.

ShorTeX defines an efficient syntax for changing fonts and applying accents to characters. The syntax takes the form `\f[modifiers]character`, where `modifiers` is a set of single characters that represent font/accent modifications to `character`. For example, the code for tilde caligraphic A is `\f[tc]A` where `t` represents "tilde," `c` represents "caligraphic," and `A` is the character to typeset.

Note: modifiers are applied in the reverse of the order in which they appear; the modifier furthest to the right is applied first. This matches the order that the corresponding commands would appear in TeX code.

Style/Accent	Modifier	Example	Typeset Example
caligraphic (`mathcal`)	`c`	`\f[c]A`	$\mathcal{A}$
bold (`mathbf`)	`k`	`\f[k]A`	$\boldsymbol{A}$
doublestroke (`mathbb`)	`d`	`\f[d]A`	$\mathbb{A}$
hat (`widehat`)	`h`	`\f[h]A`	$\widehat{A}$
tilde (`widetilde`)	`t`	`\f[t]A`	$\widetilde{A}$
bar (`widebar`)	`b`	`\f[b]A`	$\overline{A}$

These style modifiers can be combined; the underlying code is flexible enough that it will happily produce a wide variety of combinations, including those that aren't very sensible.

Style/Accent	Modifier	Example	Typeset Example
caligraphic tilde	`ct`	`\f[ct]A`	$\widetilde{\mathcal{A}}$
bold hat	`kh`	`\f[kh]A`	$\widehat{\boldsymbol{A}}$
hat tilde	`ht`	`\f[ht]A`	$\widetilde{\widehat{A}}$
tilde hat	`th`	`\f[th]A`	$\widehat{\widetilde{A}}$

We can avoid typing `[]` for commonly used patterns by parsing the font style string in advance. For example, if we use "bold hat" symbols frequently, we might want to use commands like `\fkh...` instead of `\f[kh]...`. We can accomplish this using the `\parsefontstylestrings` command, with syntax

```
\parsefontstylestrings{{<fstr1>}{<fstr2}...}{<alphabet>}
```

For example, to define "bold hat" and "caligraphic hat" styles for the characters A, B, C, and D, we would use the command

```
\parsefontstylestrings{{kh}{ch}}{ABCD}
```

and then in the LaTeX document, use the commands `\fkhA \fkhB \fkhC \fkhD` and `\fchA \fchB \fchC \fchD` to obtain the following symbols:

$$\widehat{\boldsymbol{A}}\widehat{\boldsymbol{B}}\widehat{\boldsymbol{C}}\widehat{\boldsymbol{D}}\widehat{\mathcal{A}}\widehat{\mathcal{B}}\widehat{\mathcal{C}}\widehat{\mathcal{D}}$$

As another example, for "bold hat" applied to α, β, and γ, we would use the syntax

```
\parsefontstylestrings{{kh}}{\alpha\beta\gamma}
```

and then in the LaTeX document, use the commands `\fkhalpha \fkhbeta \fkhgamma` to obtain the following symbols:

$$\widehat{\boldsymbol{\alpha}}\widehat{\boldsymbol{\beta}}\widehat{\boldsymbol{\gamma}}$$

For convenience we also provide a few common alphabets of symbols for use in the `\parsefontstylestrings` command. Note that not every Greek character has an uppercase version (in cases where it is identical to its Roman counterpart).

Syntax	Characters
`\lowercaseRoman`	abcdefghijklmnopqrstuvwxyz
`\uppercaseRoman`	ABCDEFGHIJKLMNOPQRSTUVWXYZ
`\lowercaseGreek`	alpha,beta,gamma,delta,epsilon,zeta,eta,theta iota,kappa,lambda,mu,nu,xi,omicron,pi,rho sigma,tau,upsilon,phi,chi,psi,omega
`\uppercaseGreek`	Gamma,Delta,Theta,Lambda,Xi,Pi,Sigma Upsilon,Phi,Psi,Omega

3.4 Greek characters and variants

Letter	Syntax	Symbol
epsilon	`\eps`	ϵ
upsilon	`\ups`	υ
variant epsilon	`\veps`	ε
variant theta	`\vtheta`	ϑ
variant pi	`\vpi`	ϖ
variant rho	`\vrho`	ϱ
variant sigma	`\vsigma`	ς
variant phi	`\vphi`	φ
variant kappa	`\vkappa`	$\varkappa$

4 Custom macros

4.1 Commenting

ShorTeX defines two types of comments that can be used (*remarks* and *problems*), and provides an inline and margin style for each.

Comment Type	Syntax
remark	`\RMK{Example remark}`
margin remark	`\mRMK{Example margin remark}`
problem	`\PRB{Example problem}`
margin problem	`\mPRB{Example margin problem}`

Here is an example of how these look in a typical paragraph:

Lorem ipsum dolor sit amet **(!)** Here is an inline remark, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation **(!!) Here is an inline problem** ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in [(1)] voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat [((2))] cupidatat non proident, sunt...

(1) Here is a margin remark

((2)) **Here is a margin problem**

4.2 Sets and set operations

$$\mathbb{R}\overline{\mathbb{R}}\mathbb{R}_+\overline{\mathbb{R}}_+\mathbb{R}_{++}\overline{\mathbb{R}}_{++}\mathbb{Z}\mathbb{Z}_+\mathbb{Q}\mathbb{Q}_+\mathbb{N}\mathbb{N}_0\mathbb{C}\mathcal{M}\mathcal{M}_1\mathcal{P}\cup\bigcup\sqcup\bigsqcup\cap\bigcap\operatorname{vol}\operatorname{diam}\operatorname{cl}\operatorname{span}\partial\operatorname{cone}\operatorname{conv}$$

4.3 Linear algebra

$$\operatorname{tr}\otimes A^\dagger\,\sigma\operatorname{diag}\operatorname{rank}A^\top A^{-\top}$$

4.4 Calculus

$$\mathrm{d}\nabla\frac{\mathrm{d}x}{\mathrm{d}y}\frac{\mathrm{d}^2x}{\mathrm{d}y^2}\frac{\mathrm{d}}{\mathrm{d}y}\frac{\partial x}{\partial y}\frac{\partial^2x}{\partial y^2}\frac{\partial^i x}{\partial y^i}\frac{\partial}{\partial y}\frac{\partial^2 a}{\partial x\partial y}\frac{\partial^2}{\partial x\partial y}$$

4.5 General mathematics

$$\mathbb{1}\operatorname{sgn}3\times10^5\ :|$$

improved square root
text in math?

$$:==:\ 1/2\,1/3\,1/4\arg\max\operatorname{ess\,sup}\arg\min\operatorname{ess\,inf}$$

4.6 Common words and names with accents

càdlàg Grönwall Rényi Hölder Itô Nyström Schätten Matérn Fréchet Lévy

4.7 Probability and statistics

i.i.d. a.s. a.e.

$$\overset{a.s.}{\to}\overset{p}{\to}\overset{d}{\to}\overset{d}{=}\overset{a.s.}{=}\ \mathbb{P}\mathbb{E}\mathcal{L}\operatorname{Var}\operatorname{Cov}\operatorname{Corr}\operatorname{supp}\sim\overset{\text{iid}}{\sim}\overset{\text{ind}}{\sim}\perp\!\!\!\perp$$

$$\mathcal{N}\mathcal{T}\mathcal{W}\mathcal{I}\mathcal{W}\text{Lap}\chi^2\text{UnifGamGumbelGEVCategoricalInvGamPoiss}$$
$$\text{ExpBetaBeta}'\text{DirBinomMultiBernGeomCauchyvMF}$$
$$\text{BePDPCRPPYGPPPBPBPPΓPNΓPLPObsCRMNCRM}$$

$$\mathrm{D}_{\mathrm{KL}}(q||p)\mathrm{D}_{\mathrm{H}}(q,p)\mathrm{D}_{\mathrm{TV}}(q,p)\mathcal{H}(q)$$
$$\mathrm{D}^{\mathrm{a}}_{\mathrm{H}}(q,p)\mathrm{D}^{\mathrm{a}}_{\mathrm{TV}}(q,p)\mathrm{D}^{\mathrm{a}}_{\mathrm{KL}}(q||p)$$

4.8 L_p Spaces and Operators

Description	Example	Text style	Display
L_p space	`\Lp{2}`	L_2	L_2
L_p space for specified measure	`\Lpmeas{2}{\f[h]\mu}`	$L_2(\widehat{\mu})$	$L_2(\widehat{\mu})$
	`\Lpmeas[\Big]{2}{\f[h]\mu}`	$L_2\Big(\widehat{\mu}\Big)$	$L_2\Big(\widehat{\mu}\Big)$
L_p norm	`\Lpnorm{\f[h]\Gamma}{2}`	$\|\widehat{\Gamma}\|_{L_2}$	$\|\widehat{\Gamma}\|_{L_2}$
	`\Lpnorm*{\f[h]\Gamma}{2}`	$\left\|\widehat{\Gamma}\right\|_{L_2}$	$\left\|\widehat{\Gamma}\right\|_{L_2}$
	`\Lpnorm*{\Gamma}{2}`	$\|\Gamma\|_{L_2}$	$\|\Gamma\|_{L_2}$
	`\left\Vert{\f[h]\Gamma}\right\Vert_{2}`	$\left\|\widehat{\Gamma}\right\|_{2}$	$\left\|\widehat{\Gamma}\right\|_{2}$
	`\left\Vert{\Gamma}\right\Vert_{2}`	$\|\Gamma\|_{2}$	$\|\Gamma\|_{2}$
L_p norm for specified measure	`\Lpmeasnorm{\f[h]\Gamma}{2}{\f[h]\mu}`	$\|\widehat{\Gamma}\|_{L_2(\widehat{\mu})}$	$\|\widehat{\Gamma}\|_{L_2(\widehat{\mu}}$
	`\Lpmeasnorm[\Big]{\f[h]\Gamma}{2}{\f[h]\mu}`	$\left\|\widehat{\Gamma}\right\|_{L_2(\widehat{\mu})}$	$\left\|\widehat{\Gamma}\right\|_{L_2(\widehat{\mu}}$
L_p inner product	`\Lpinner{\f[h]\Gamma}{\Gamma}{2}`	$\langle\widehat{\Gamma},\Gamma\rangle_{L_2}$	$\langle\widehat{\Gamma},\Gamma\rangle_{L_2}$
	`\Lpinner*{\f[h]\Gamma}{\Gamma}{2}`	$\left\langle\widehat{\Gamma},\Gamma\right\rangle_{L_2}$	$\left\langle\widehat{\Gamma},\Gamma\right\rangle_{L}$
L_p inner product for specified measure	`\Lpmeasinner{\f[h]\Gamma}{\Gamma}{2}{\f[h]\mu}`	$\langle\widehat{\Gamma},\Gamma\rangle_{L_2(\widehat{\mu})}$	$\langle\widehat{\Gamma},\Gamma\rangle_{L_2}$
	`\Lpmeasinner[\big]{\f[h]\Gamma}{\Gamma}{2}{\f[h]\mu}`	$\big\langle\widehat{\Gamma},\Gamma\big\rangle_{L_2(\widehat{\mu})}$	$\big\langle\widehat{\Gamma},\Gamma\big\rangle_{L}$

5 Example Document

TODO: a full example in basic latex versus shortex

5.1 Paired Delimiters

You can specify a bracket size using $*$ for `\left` and `\right` or one of the standard size choices (`\big`, `\Big`, `\bigg`, `\Bigg`).

Description	Example	Text style	Display style
Round brackets	`\rbra{\frac{x}{y}}`	$(\frac{x}{y})$	$(\dfrac{x}{y})$
Curly brackets	`\cbra*{\frac{x}{y}}`	$\left\{\frac{x}{y}\right\}$	$\left\{\dfrac{x}{y}\right\}$
Square brackets	`\sbra[\bigg]{\frac{x}{y}}`	$\left[\frac{x}{y}\right]$	$\left[\dfrac{x}{y}\right]$

Many other bracket-like, semantic commands are also available:

Description	Example	Text style	Display style
Absolute value	`\abs{\frac{x}{y}}`	$\lvert\frac{x}{y}\rvert$	$\lvert\dfrac{x}{y}\rvert$
Set	`\set{\frac{x}{y}, \frac{y}{z}}`	$\{\frac{x}{y}, \frac{y}{z}\}$	$\{\dfrac{x}{y}, \dfrac{y}{z}\}$
Floor	`\floor{\frac{x}{y}}`	$\lfloor\frac{x}{y}\rfloor$	$\lfloor\dfrac{x}{y}\rfloor$
Ceiling	`\ceil{\frac{x}{y}}`	$\lceil\frac{x}{y}\rceil$	$\lceil\dfrac{x}{y}\rceil$
Norm	`\norm{\frac{x}{y}}`	$\lVert\frac{x}{y}\rVert$	$\lVert\dfrac{x}{y}\rVert$
Inner product	`\inner{\frac{x}{y}}{\frac{y}{z}}`	$\langle\frac{x}{y}, \frac{y}{z}\rangle$	$\langle\dfrac{x}{y}, \dfrac{y}{z}\rangle$
Cardinality	`\card{\f[h]A}`	$\lvert\widehat{A}\rvert$	$\lvert\widehat{A}\rvert$

The norm and inner product commands also have versions with a subscript argument:

Description	Example	Text style	Display style
Norm with subscript	`\normsub*{\frac{x}{y}}{2}`	$\left\lVert\frac{x}{y}\right\rVert_2$	$\left\lVert\dfrac{x}{y}\right\rVert_2$
Inner product with subscript	`\innersub*{\frac{x}{y}}{z}{2}`	$\left\langle\frac{x}{y}, z\right\rangle_2$	$\left\langle\dfrac{x}{y}, z\right\rangle_2$