The okicmd and okithm Packages

Taihei Oki

April 27, 2020

1 The okicmd Package

1.1 Letters

Input	Output	LaTeX equivalent
`l`	ℓ	`\ell`
`\ell`	l	`l`
`\epsilon`	ε	`\varepsilon`
`\varepsilon`	ϵ	`\epsilon`
`\phi`	φ	`\varphi`
`\varphi`	ϕ	`\phi`

1.2 Parentheses

Input	Output	LaTeX (almost) equivalent
`\prn{\cdot}`	$(\cdot)$	`\left(\cdot\right)`[1]
`\prn*{\cdot}`	$(\cdot)$	`(\cdot)`
`\prn[\big]{\cdot}`	$\bigl(\cdot\bigr)$	`\bigl(\cdot\bigr)`
`\prn[\Big]{\cdot}`	$\Bigl(\cdot\Bigr)$	`\Bigl(\cdot\Bigr)`
`\prn[\bigg]{\cdot}`	$\biggl(\cdot\biggr)$	`\biggl(\cdot\biggr)`
`\prn[\Bigg]{\cdot}`	$\Biggl(\cdot\Biggr)$	`\Biggl(\cdot\Biggr)`
`\curl{\cdot}`	$\{\cdot\}$	`\left\{\cdot\right\}`
`\sqbr{\cdot}`	$[\cdot]$	`\left[\cdot\right]`
`\agbr{\cdot}`	$\langle\cdot\rangle$	`\left\langle\cdot\right\rangle`
`\dbbr{\cdot}`	$[\![\cdot]\!]$	`\left\llbracket\cdot\right\rrbracket`
`\pipe{\cdot}`	$\lvert\cdot\rvert$	`\left|\cdot\right|`
`\dbpp{\cdot}`	$\lVert\cdot\rVert$	`\left\\|\cdot\right\\|`
`\floor{\cdot}`	$\lfloor\cdot\rfloor$	`\left\lfloor\cdot\right\rfloor`
`\ceil{\cdot}`	$\lceil\cdot\rceil$	`\left\lceil\cdot\right\rceil`

[1] The exactly equivalent LaTeX code is `\mathopen{\left(\vphantom{\cdot}\kern-\nulldelimiterspace \right.}\cdot\mathclose{\left.\kern-\nulldelimiterspace\vphantom{\cdot}\right)}`. This is the same for other parenthesis commands.

1.3 Logic

Input	Output	LaTeX equivalent
`\bigland`	$\bigwedge$	`\bigwedge`
`\biglor`	$\bigvee$	`\bigvee`
`a \defeq b`	$a \coloneqq b$	`a \coloneqq b`
`a \eqdef b`	$b \eqqcolon a$	`a \eqqcolon b`
`P \defiff Q`	$P \overset{\mathrm{def}}{\iff} Q$	`P \overset{\mathrm{def}}{\iff} Q`

1.4 Sets

Input	Output	LaTeX (almost) equivalent
`\set{a \in S}`	$\{a \in S\}$	`\left\{a \in S\right\}`
`\set{a \in S}[a^2 = 1]`	$\{a \in S \mid a^2 = 1\}$	`\left\{a \in S\mathrel{}\middle|\mathrel{}a^2 = 1\right\}`[2]
`\card{X}`	$\lvert X\rvert$	`\left|X\right|`
`X \symdif Y`	$X \mathbin{\triangle} Y$	`X \mathbin{\triangle} Y`
`\setN`	$\mathbb{N}$	`\mathbb{N}`
`\setZ`	$\mathbb{Z}$	`\mathbb{Z}`
`\setQ`	$\mathbb{Q}$	`\mathbb{Q}`
`\setR`	$\mathbb{R}$	`\mathbb{R}`
`\setC`	$\mathbb{C}$	`\mathbb{C}`
`\setH`	$\mathbb{H}$	`\mathbb{H}`
`\setF`	$\mathbb{F}$	`\mathbb{F}`
`\setK`	$\mathbb{K}$	`\mathbb{K}`
`\setZp`	$\mathbb{Z}_{\ge 0}$	`\mathbb{Z}_{\ge0}`
`\setQp`	$\mathbb{Q}_{\ge 0}$	`\mathbb{Q}_{\ge0}`
`\setRp`	$\mathbb{R}_{\ge 0}$	`\mathbb{R}_{\ge0}`
`\setNpp`	$\mathbb{N}_{>0}$	`\mathbb{N}_{>0}`
`\setZpp`	$\mathbb{Z}_{>0}$	`\mathbb{Z}_{>0}`
`\setQpp`	$\mathbb{Q}_{>0}$	`\mathbb{Q}_{>0}`
`\setRpp`	$\mathbb{R}_{>0}$	`\mathbb{R}_{>0}`

1.5 Maps

Input	Output	LaTeX (almost) equivalent
`\doms{X}{Y}`	$X \to Y$	`{X}\to{Y}`
`\funcdoms{f}{X}{Y}`	$f : X \to Y$	`{f}\vcentcolon{X}\to{Y}`
`\restr{f}{S}`	$f\rvert_S$	`\left.f\right|_{S}`
`\id_K`	id_K	`\operatorname{id}_K`
`\dom f`	$\operatorname{dom} f$	`\operatorname{dom} f`
`\cod f`	$\operatorname{cod} f$	`\operatorname{cod} f`
`\supp f`	$\operatorname{supp} f$	`\operatorname{supp} f`

[2] The exactly equivalent LaTeX code is `\mathopen{\left\{\vphantom{a \in Sa^2 = 1}\kern-\nulldelimiterspace\right.}a \in S\mathrel{\left.\kern-\nulldelimiterspace\vphantom{a \in Sa^2 = 1}\middle|\kern-\nulldelimiterspace\right.}a^2 = 1\mathclose{\left.\kern-\nulldelimiterspace\vphantom{a \in Sa^2 = 1}\right\}}`. This is the same for other parenthesis commands with middle bars.

1.6 Lattices

Input	Output	LaTeX equivalent
`x \meet y`	$x \wedge y$	`x \mathbin{\wedge} y`
`x \join y`	$x \vee y$	`x \mathbin{\vee} y`
`\bigmeet`	$\bigwedge$	`\bigwedge`
`\bigjoin`	$\bigvee$	`\bigvee`

1.7 Algebra

<table>
<tr><th>Input</th><th>Output</th><th>LaTeX (almost) equivalent</th></tr>
<tr><td><code>\Hom(G)</code></td><td>$\operatorname{Hom}(G)$</td><td><code>\operatorname{Hom}(G)</code></td></tr>
<tr><td><code>\End R</code></td><td>$\operatorname{End} R$</td><td><code>\operatorname{End} R</code></td></tr>
<tr><td><code>\Aut_k K</code></td><td>$\operatorname{Aut}_k K$</td><td><code>\operatorname{Aut}_k K</code></td></tr>
<tr><td><code>\gen{a,b}</code></td><td>$\langle a, b\rangle$</td><td><code>\left\langlea,b\right\rangle</code></td></tr>
<tr><td><code>\gen{a,b}[ab = e]</code></td><td>$\langle a, b \mid ab = e\rangle$</td><td><code>\left\langlea,b\mathrel{}\middle|</code>
<code>\mathrel{}ab = e\right\rangle</code></td></tr>
<tr><td><code>\abel{G}</code></td><td>G_{ab}</td><td><code>G_{\mathrm{ab}}</code></td></tr>
<tr><td><code>\comm{G}</code></td><td>$[G, G]$</td><td><code>\left[G, G\right]</code></td></tr>
<tr><td><code>\ord G</code></td><td>$\operatorname{ord} G$</td><td><code>\operatorname{ord} G</code></td></tr>
<tr><td><code>\sym_n</code></td><td>$\mathfrak{S}_n$</td><td><code>\mathfrak{S}_n</code></td></tr>
<tr><td><code>\sgn(\sigma)</code></td><td>$\operatorname{sgn}(\sigma)$</td><td><code>\operatorname{sgn}(\sigma)</code></td></tr>
<tr><td><code>\mult{R}</code></td><td>$R^{\times}$</td><td><code>R^{\times}</code></td></tr>
<tr><td><code>\M_{m,n}(R)</code></td><td>$\operatorname{M}_{m,n}(R)$</td><td><code>\operatorname{M}_{m,n}(R)</code></td></tr>
<tr><td><code>\GL_n(R)</code></td><td>$\operatorname{GL}_n(R)$</td><td><code>\operatorname{GL}_n(R)</code></td></tr>
<tr><td><code>\SL_n(R)</code></td><td>$\operatorname{SL}_n(R)$</td><td><code>\operatorname{SL}_n(R)</code></td></tr>
<tr><td><code>\O(n)</code></td><td>$\operatorname{O}(n)$</td><td><code>\operatorname{O}(n)</code></td></tr>
<tr><td><code>\SO(n)</code></td><td>$\operatorname{SO}(n)$</td><td><code>\operatorname{SO}(n)</code></td></tr>
<tr><td><code>\U(n)</code></td><td>$\operatorname{U}(n)$</td><td><code>\operatorname{U}(n)</code></td></tr>
<tr><td><code>\SU(n)</code></td><td>$\operatorname{SU}(n)$</td><td><code>\operatorname{SU}(n)</code></td></tr>
<tr><td><code>\GL(q)</code></td><td>$\operatorname{GL}(q)$</td><td><code>\operatorname{GL}(q)</code></td></tr>
<tr><td><code>L \extends K</code></td><td>$L \mathbin{/} K$</td><td><code>L \mathbin{/} K</code></td></tr>
</table>

1.8 Number Theory

<table>
<tr><th>Input</th><th>Output</th><th>LaTeX (almost) equivalent</th></tr>
<tr><td><code>\abs{x}</code></td><td>$\lvert x\rvert$</td><td><code>\left|x\right|</code></td></tr>
<tr><td><code>\intset{n}</code></td><td>$[n]$</td><td><code>\left[n\right]</code></td></tr>
<tr><td><code>a \coprime b</code></td><td>$a \perp b$</td><td><code>a \mathrel{\bot} b</code></td></tr>
<tr><td><code>a \divides b</code></td><td>$a \mid b$</td><td><code>a \mid b</code></td></tr>
<tr><td><code>a \ndivides b</code></td><td>$a \nmid b$</td><td><code>a \nmid b</code></td></tr>
</table>

1.9 Linear Algebra

Input	Output	LaTeX (almost) equivalent
`\tr A`	$\operatorname{tr} A$	`\operatorname{tr} A`
`\rank A`	$\operatorname{rank} A$	`\operatorname{rank} A`
`\trank A`	$\operatorname{t-rank} A$	`\operatorname{t-rank} A`
`\Pf A`	$\operatorname{Pf} A$	`\operatorname{Pf} A`
`\diag(a_1,\dotsc,a_n)`	$\operatorname{diag}(a_1,\dotsc,a_n)$	`\operatorname{diag} (a_1,\dotsc,a_n)`
`\blockdiag(A_1,\dotsc,A_n)`	$\operatorname{block-diag}(A_1,\dotsc,A_n)$	`\operatorname{block-diag} (A_1,\dotsc,A_n)`
`\vectorize(A)`	$\operatorname{vec}(A)$	`\operatorname{vectorize}(A)`
`\Row(A)`	$\operatorname{Row}(A)$	`\operatorname{Row}(A)`
`\Col(A)`	$\operatorname{Col}(A)$	`\operatorname{Col}(A)`
`\onevec`	$\mathbb{1}$	`\mathds{1}`
`\trsp{A}`	$A^\top$	`A^\top`
`\adjo{A}`	A^*	`A^*`
`\inpr{x}{y}`	$\langle x, y\rangle$	`\left\langle{x},{y} \right\rangle`

1.10 Analysis

Input	Output	LaTeX (almost) equivalent
`\intoo{a,b}`	(a,b)	`\left(a,b\right)`
`\intoc{a,b}`	$(a,b]$	`\left(a,b\right]`
`\intco{a,b}`	$[a,b)$	`\left[a,b\right)`
`\intcc{a,b}`	$[a,b]$	`\left[a,b\right]`
`\e`	e	`\mathrm{e}`
`\d`	d	`\mathrm{d}`
`\dif{f}{x}`	$\frac{\mathrm{d} f}{\mathrm{d} x}$	`\frac{\mathrm{d} f}{\mathrm{d} x}`
`\pdif{f}{x}`	$\frac{\partial f}{\partial x}$	`\frac{\partial f}{\partial x}`
`\ddif{f}{x}`	$\dfrac{\mathrm{d} f}{\mathrm{d} x}$	`\dfrac{\mathrm{d} f}{\mathrm{d} x}`
`\dpdif{f}{x}`	$\dfrac{\partial f}{\partial x}$	`\dfrac{\partial f}{\partial x}`

1.11 Complex Analysis

Input	Output	LaTeX equivalent
`\i`	i	`\mathrm{i}`
`\Re z`	$\operatorname{Re} z$	`\operatorname{Re} z`
`\Im z`	$\operatorname{Im} z$	`\operatorname{Im} z`
`\Arg z`	$\operatorname{Arg} z$	`\operatorname{Arg} z`
`\Log z`	$\operatorname{Log} z$	`\operatorname{Log} z`
`\Sin z`	$\operatorname{Sin} z$	`\operatorname{Sin} z`
`\Cos z`	$\operatorname{Cos} z$	`\operatorname{Cos} z`
`\Tan z`	$\operatorname{Tan} z$	`\operatorname{Tan} z`
`\Res_{z=0} f(z)`	$\operatorname{Res}_{z=0} f(z)$	`\operatorname*{Res}_{z=0} f(z)`

1.12 Optimization

Input	Output	LaTeX equivalent
`\argmin_{x \in S} f(x)`	$\operatorname*{arg\,min}_{x \in S} f(x)$	`\operatorname*{arg~min}_{x \in S} f(x)`
`\argmax_{x \in S} f(x)`	$\operatorname*{arg\,max}_{x \in S} f(x)$	`\operatorname*{arg~max}_{x \in S} f(x)`
`\Order(n)`	$\mathrm{O}(n)$	`\mathrm{O}(n)`
`\order(n)`	$\mathrm{o}(n)$	`\mathrm{o}(n)`

2 The okithm Package

2.1 Theorems

If the language is set to Japanese like by `\usepackage[main = japanese]{babel}`, okithm will translate all the environment titles (Theorem, Definition, etc.) into Japanese. You can disable theorems by giving the option `notheorem` to okicmd.

```
\begin{theorem}[Awesome theorem]
  The square root $\sqrt{2}$ of two is irrational.
\end{theorem}

\begin{definition}[Coprime]
  Integers $a$ and $b$ are said to be \emph{coprime} if their greatest common
  divisor is one.
\end{definition}

\begin{lemma}
  If $a$ and $b$ are coprime, so are $a^2$ and $b^2$.
\end{lemma}

\begin{proposition}
  If $\sqrt{2} = a/b$, then $a^2 = 2b^2$.
\end{proposition}

\begin{corollary}
  If $\sqrt{2} = a/b$ with $a$ and $b$ being coprime, then $a$ is even.
\end{corollary}

\begin{example}
  If $a = 2$ and $b = 1$, then $a$ is even but $\sqrt{2} \ne a/b$.
\end{example}

\begin{remark}
  Note that $a$ and $b$ must be integers.
\end{remark}

\begin{proof}[of Awesome theorem]
  Suppose to the contrary that $\sqrt{2} = a/b$ with coprime $a$ and $b$.
  Then both $a$ and $b$ are even, which contradicts the assumption.
\end{proof}
```

Theorem 2.1 (Awesome theorem)**.** *The square root $\sqrt{2}$ of two is irrational.*

Definition 2.2 (Coprime)**.** Integers a and b are said to be *coprime* if their greatest common divisor is one.

Lemma 2.3. *If a and b are coprime, so are a^2 and b^2.*

Proposition 2.4. *If $\sqrt{2} = a/b$, then $a^2 = 2b^2$.*

Corollary 2.5. *If $\sqrt{2} = a/b$ with a and b being coprime, then a is even.*

Example 2.6. If $a = 2$ and $b = 1$, then a is even but $\sqrt{2} \neq a/b$. □

Remark 2.7. Note that a and b must be integers.

Proof (of Awesome theorem). Suppose to the contrary that $\sqrt{2} = a/b$ with coprime a and b. Then both a and b are even, which contradicts the assumption. □

2.2 Algorithms

You can disable algorithms by setting the option `noalgorithm`.

```
\begin{algorithmic}[1]
  \Input{$n \in \setN$}
  \Output{$n(n+1)/2$}
  \State{$s \gets 0$}
  \ForTo{$i = 1$}{$n$}
  \State{$s \gets s + i$}
  \EndFor
  \State{\Return $s$}
\end{algorithmic}
```

Input : $n \in \mathbb{N}$
Output: $n(n+1)/2$
1: $s \leftarrow 0$
2: **for** $i = 1$ **to** n **do**
3: $\quad s \leftarrow s + i$
4: **return** s

2.3 Optimization Problems

You can change `minimize`, `maximize` and `subject to` into `min`, `max` and `s.t.`, respectively, by setting the option `optstyle = short`.