

## 1 Options

Options are processes left-to-right. If no options are provided, or none are enabled by the end of the processing, then by default they are all considered to be enabled.

Option	Description
<code>all</code>	Enable all commands
<code>(no-)math</code>	Disable/enable mathematical commands
<code>(no-)linalg</code>	Disable/enable linear algebra commands
<code>(no-)optim</code>	Disable/enable optimization commands
<code>(no-)stats</code>	Disable/enable statistics commands
<code>(no-)dists</code>	Disable/enable distributions commands
<code>(no-)ml</code>	Disable/enable machine learning commands
<code>(no-)rl</code>	Disable/enable reinforcement learning commands
<code>(no-)marl</code>	Disable/enable multi-agent reinforcement learning commands
<code>(no-)theorem</code>	Disable/enable theorem commands
<code>(no-)misc</code>	Disable/enable miscellanea commands

## 2 Commands

### Option `[math]`

Symbol	Command	Description	Example
$\mathbb{N}$	<code>\naturalset</code>	the set of natural numbers	$\mathbb{N} \doteq \{1, 2, 3, \dots\}$
$\mathbb{Z}$	<code>\integerset</code>	the set of integer numbers	$\mathbb{Z} \doteq \{0, 1, -1, 2, -3, \dots\}$
$\mathbb{R}$	<code>\realset</code>	the set of real numbers	$\sqrt{2} \in \mathbb{R}$
$*$	<code>\kstar</code>	the Kleene star operator	$\mathcal{X}^* \doteq \bigcup_{k=0}^{\infty} \mathcal{X}^k$
$+$	<code>\kplus</code>	the Kleene plus operator	$\mathcal{X}^+ \doteq \bigcup_{k=1}^{\infty} \mathcal{X}^k$
<code>softmax</code>	<code>\softmax</code>	a.k.a. <code>logsumexp</code> , <code>realsoftmax</code> <sup>1</sup>	$\text{softmax}(x_1, \dots, x_n) \doteq \log \sum_i \exp(x_i)$
<code>softmin</code>	<code>\softmin</code>		$\text{softmin}(x_1, \dots, x_n) \doteq -\log \sum_i \exp(-x_i)$
<code>softargmax</code>	<code>\softargmax</code>	a.k.a. <code>softmax</code> <sup>1</sup>	$\text{softargmax}(x_1, \dots, x_n)_i \doteq \frac{\exp(x_i)}{\sum_k \exp(x_k)}$
<code>sign</code>	<code>\sign</code>		$x = \text{sign } x \cdot  x $
<code>supp</code>	<code>\supp</code>	support operator	$\text{supp}(f) \doteq \{x \mid f(x) \neq 0\}$

<sup>1</sup>The functions that in this document are called “softmax” and “softargmax” are poorly and inaccurately named in the broader math and ML fields (see [https://en.wikipedia.org/wiki/Softmax\\_function](https://en.wikipedia.org/wiki/Softmax_function) and <https://en.wikipedia.org/wiki/LogSumExp>). Rather than stick to the more common naming conventions, I opt to rename the functions more accurately to appropriately reflect their actual properties. In any document where I would use these functions, I would need to define them anyway, so the risk of misunderstandings are minimal.

## Option [linalg]

Symbol	Command	Description	Example
diag	<code>\diag</code>		
rank	<code>\rank</code>		
tr	<code>\trace</code>		$\text{tr}(M) \doteq \sum_{i=1}^n M_{ii}$
col	<code>\colspace</code>		
ker	<code>\nullspace</code>	Nullspace (a.k.a kernel) of a linear mapping	
span	<code>\spanspace</code>		
$^{\top}$	<code>\T</code>	Transpose superscript	symmetric $M \implies M = M^{\top}$
$^{-1}$	<code>\I</code>	Inverse superscript	invertible $M \implies MM^{-1} = I$
$^{+}$	<code>\PI</code>	Pseudo-inverse superscript	$MM^{+}M = M$
$^{-\top}$	<code>\IT</code>	Inverse transpose superscript	$M^{-\top} = (M^{-1})^{\top} = (M^{\top})^{-1}$
$^{+\top}$	<code>\PIT</code>	Pseudo-inverse transpose superscript	$M^{+\top} = (M^{+})^{\top} = (M^{\top})^{+}$

## Option [optim]

Symbol	Command	Description	Example
argmax	<code>\argmax</code>		$\text{argmax}_a Q^{\pi}(s, a)$
argmin	<code>\argmin</code>		$\theta^{*} \doteq \text{argmin}_{\theta} \mathcal{L}(\theta)$
$^{*}$	<code>\opt</code>	Optimality superscript	$\pi^{*}(s) = \text{argmax}_a Q^{*}(s, a)$
stop	<code>\stopg</code>	Stop-gradient operator	$\nabla_x \text{stop}[f(x)] = 0$

## Option [stats]

Symbol	Command	Description	Example
$\perp$	<code>\indep</code>	Independence	$X \perp Y \mid Z$
do	<code>\causaldo</code>	Pearl's <i>do</i> operator	$\Pr(Y \mid \text{do}(X = x)) \neq \Pr(Y \mid X = s)$
$\mathbb{C}$	<code>\Cov</code>	Covariance	$\mathbb{C}(x, y) = \mathbb{E}[xy] - \mathbb{E}[x]\mathbb{E}[y]$
$\mathbb{H}$	<code>\Ent</code>	Entropy	$\mathbb{H}[x] = -\mathbb{E}[\log \Pr(x)]$
$\mathbb{E}$	<code>\Exp</code>	Expectation	$\mathbb{E}[f(x)] = \sum_x \Pr(x)f(x)$
$\mathbb{I}$	<code>\Ind</code>	Indicator function	$\Pr(x = 0) = \mathbb{E}[\mathbb{I}[x = 0]]$
KL	<code>\KL</code>	KL-divergence	$\text{KL}(p \parallel q) \doteq \mathbb{E}_{x \sim p}[\log p(x) - \log q(x)]$
$\text{D}_{\text{KL}}$	<code>\DKL</code>	KL-divergence (alternative)	
$\mathbb{I}$	<code>\MI</code>	Mutual Information	
$\mathbb{B}$	<code>\Bias</code>	Bias	$\mathbb{B}[\hat{f}(x)]$ is the bias of estimator $\hat{f}$
$\mathbb{V}$	<code>\Var</code>	Variance	$\mathbb{V}[\hat{f}(x)] = \mathbb{E}[\hat{f}(x)^2] - \mathbb{E}[\hat{f}(x)]^2$

## Option [dists]

Symbol	Command	Description	Example
Categorical	<code>\Categorical</code>	Categorical	
Dirichlet	<code>\Dirichlet</code>	Dirichlet	
Geometric	<code>\Geometric</code>	Geometric	
Normal	<code>\Normal</code>	Normal	
Uniform	<code>\Uniform</code>	Uniform	

## Option [ml]

Symbol	Command	Description	Example
$\mathcal{D}$	<code>\data</code>	Data set	$\mathcal{D} \doteq \{(x_i, y_i)\}_{i=1}^N$
$\mathcal{L}$	<code>\loss</code>	Loss function	$\mathcal{L}(\theta; x, y) = \frac{1}{2} \ y - f(x; \theta)\ ^2$
nll	<code>\nll</code>	Neg-log-likelihood	$\text{nll}(x) \doteq -\log \Pr(x)$
MSE	<code>\mse</code>	Mean-squared-error	

## Option [rl]

Symbol	Command	Description	Example
$\mathcal{A}$	<code>\aset</code>	Action set	
$\mathcal{B}$	<code>\bset</code>	Belief set	
$\mathcal{H}$	<code>\hset</code>	History set	
$\mathcal{O}$	<code>\oset</code>	Observation set	
$\mathcal{R}$	<code>\rset</code>	Reward set	
$\mathcal{S}$	<code>\sset</code>	State set	
$\varepsilon$	<code>\nohistory</code>	Empty history	
$\pi$	<code>\policy</code>	policy	
$Q^\pi$	<code>\qpolicy</code>	Q policy values	
$Q^\mu$	<code>\qpolicy[\mu]</code>	Q policy values w/ optional argument	
$\hat{Q}$	<code>\qmodel</code>	Parametric model	
$V^\pi$	<code>\vpolicy</code>	V policy values	
$V^\mu$	<code>\vpolicy[\mu]</code>	V policy values w/ optional argument	
$\hat{V}$	<code>\vmodel</code>	Parametric model	
$A^\pi$	<code>\apolicy</code>	A policy values	
$A^\mu$	<code>\apolicy[\mu]</code>	A policy values w/ optional argument	
$\hat{A}$	<code>\amodel</code>	Parametric model	
$U^\pi$	<code>\upolicy</code>	U policy values	
$U^\mu$	<code>\upolicy[\mu]</code>	U policy values w/ optional argument	
$\hat{U}$	<code>\umodel</code>	Parametric model	
$B_\pi$	<code>\bpolicy</code>	Policy Bellman operator	
$B_\mu$	<code>\bpolicy[\mu]</code>	Policy Bellman operator w/ optional argument	

## Option [marl]

Symbol	Command	Description	Example
$\bar{x}$	<code>\joint{x}</code>	Joint formatting (redefinable)	
$\bar{\mathcal{A}}$	<code>\jaset</code>	Joint action set	
$\bar{\mathcal{O}}$	<code>\joset</code>	Joint observation set	
$\bar{\mathcal{H}}$	<code>\jhset</code>	Joint history set	
$\bar{a}$	<code>\ja</code>	Joint action	$\bar{a} \in \bar{\mathcal{A}}$
$\bar{o}$	<code>\jo</code>	Joint observation	$\bar{o} \in \bar{\mathcal{O}}$
$\bar{h}$	<code>\jh</code>	Joint history	$\bar{h} \in \bar{\mathcal{H}}$
$\bar{\pi}$	<code>\jpolicy</code>	Joint policy	$\bar{\pi}(\bar{h}, \bar{a}) \doteq \prod_i \pi_i(h_i, a_i)$
$Q^{\bar{\pi}}$	<code>\jqpolicy</code>	Q joint-policy values	
$V^{\bar{\pi}}$	<code>\jvpolicy</code>	V joint-policy values	
$A^{\bar{\pi}}$	<code>\japolicy</code>	A joint-policy values	
$U^{\bar{\pi}}$	<code>\jupolicy</code>	U joint-policy values	
$B_{\bar{\pi}}$	<code>\jbpolicy</code>	Joint policy Bellman operator	
$B_{\bar{\mu}}$	<code>\bpolicy[\joint\mu]</code>	Joint policy Bellman operator w/ optional argument	

## Option [theorem]

Symbol	Command	Description	Example
	<code>\begin{definition}, \end{definition}</code>		
	<code>\begin{assumption}, \end{assumption}</code>		
	<code>\begin{example}, \end{example}</code>		
	<code>\begin{axiom}, \end{axiom}</code>		
	<code>\begin{conjecture}, \end{conjecture}</code>		
	<code>\begin{proposition}, \end{proposition}</code>		
	<code>\begin{lemma}, \end{lemma}</code>		
	<code>\begin{theorem}, \end{theorem}</code>		
	<code>\begin{corollary}, \end{corollary}</code>		
	<code>\begin{generalization}, \end{generalization}</code>		

## Option [misc]

Symbol	Command	Description	Example
$\dagger$	<code>\D</code>	Dagger superscript	
$(^k)$	<code>\iter{k}</code>	Superscript indicating iteration	

## Option [utils]

Symbol	Command	Description	Example
$\phantom{=}$	<code>\phantomeq</code>	The width of an =, for alignment purposes (bounding box shown)	