

## 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	$\pi^*(s) = \text{argmax}_a Q^*(s, a)$

## 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
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
$\mathcal{A}$	<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
D	<code>\dfn</code>	Dynamics function
G	<code>\gfn</code>	Generative function
O	<code>\ofn</code>	Observation function
R	<code>\rfn</code>	Reward function
T	<code>\tfn</code>	Transition function
$\varepsilon$	<code>\nohistory</code>	Empty history
$\pi$	<code>\policy</code>	policy
$Q^\pi$	<code>\qpolicy</code>	Q policy values
$\hat{Q}$	<code>\qmodel</code>	Parametric model
$V^\pi$	<code>\vpolicy</code>	V policy values
$\hat{V}$	<code>\vmodel</code>	Parametric model
$A^\pi$	<code>\apolicy</code>	A policy values
$\hat{A}$	<code>\amodel</code>	Parametric model
$U^\pi$	<code>\upolicy</code>	U policy values
$\hat{U}$	<code>\umodel</code>	Parametric model

### Option [marl]

Symbol	Command	Description
$\bar{\mathcal{H}}$	<code>\hsset</code>	Joint history set
$\bar{\mathcal{A}}$	<code>\asset</code>	Joint action set
$\bar{\mathcal{O}}$	<code>\osset</code>	Joint observation set
$\bar{h}$	<code>\hs</code>	Joint history
$\bar{a}$	<code>\as</code>	Joint action
$\bar{o}$	<code>\os</code>	Joint observation
$\bar{\pi}$	<code>\policies</code>	Joint policy
$Q^{\bar{\pi}}$	<code>\qpolicies</code>	Q joint-policy values
$V^{\bar{\pi}}$	<code>\vpolicies</code>	V joint-policy values
$A^{\bar{\pi}}$	<code>\apolicies</code>	A joint-policy values
$U^{\bar{\pi}}$	<code>\upolicies</code>	U joint-policy values

## Option [theorem]

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

## Option [misc]

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