LaTeX symbol macros for CSP

Version 1.2

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This document presents the `cspsymb` package, which contains macros for generating symbols useful when writing documents concering the CSP process algebra.

N.B. All the macros presented here can only be used in maths mode, with the exception of the `\CSPM{}` *macro, which only works in text mode.*

1 Logic and Sets

Table 1: Logic and sets symbols

$\forall$	`\forall`	$\bigvee$	`\Lor`	$\bigcap$	`\Inter`
$\exists$	`\exists`	$\bigwedge$	`\Land`	$\bigcup$	`\Union`
$\nexists$	`\nexists`	$\vee$	`\lor`	$\cap$	`\inter`
$\neg$	`\lnot`	$\wedge$	`\land`	$\cup$	`\union`
$\notin$	`\nin`	$\Rightarrow$	`\implies`	dom	`\dom`
$\Leftrightarrow$	`\iff`	$\not\Rightarrow$	`\nimplies`	ran	`\ran`
$\emptyset$	`\emptyset`	$\{x\}$	`\set{x}`	$\langle x \rangle$	`\seq{x}`
$\{\,\}$	`\nullset`	$\{\mid x \mid\}$	`\eset{x}`	$\langle\rangle$	`\emptyseq`
$\vdash$	`\hence`	$\times$	`\cross`	..	`\upto`
$\mathbf{N}$	`\nats`	$\mathbf{Q}$	`\rats`	$\mathbf{P}$	`\power`
$\mathbf{Z}$	`\ints`	$\mathbf{R}$	`\reals`	$\mathbf{F}$	`\finset`
$\mathbb{N}$	`\Nats`[a]	$\mathbb{Q}$	`\Rats`[a]	$\mathbb{P}$	`\Power`[a]
$\mathbb{Z}$	`\Ints`[a]	$\mathbb{R}$	`\Reals`[a]	$\mathbb{F}$	`\Finset`[a]

[a] Available only if the amsfonts package is loaded

2 Named processes

Table 2: Symbols for named processes

$\bot$	`\bot`	**div**	`\div`[b]	*COPY*	`\COPY`
STOP	`\STOP`	*DF*	`\DF`	*BUFF*	`\BUFF`
SKIP	`\SKIP`	*RUN*	`\RUN`	*WBUFF*	`\WBUFF`
WAIT	`\WAIT`	*CHAOS*	`\CHAOS`	*FinBUFF*	`\FinBUFF`

[b] The `\div` command has been overridden to produce the symbol for divergent CSP processes. The $\div$ symbol can be obtained by using the `\xdiv` command

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3 Events and traces

Table 3: Symbols for events, alphabets and traces

$\checkmark$	`\tick`	*tock*	`\tock`	$\bullet$	`\spot`
$\Sigma^{\checkmark}$	`\Sigmatick`	$\langle\rangle$	`\nil`	$\restriction$	`\project`, `\restrict`
$\Sigma^{\checkmark,\tau}$	`\Sigmap`	$\langle x\rangle$	`\trace{x}`	$\upharpoonright$	`\during`
$\Sigma^{*\checkmark}$	`\Sigmatr`	$\hat{}$	`\cat`	$\downarrow$	`\cnt`
$(\Sigma^{\tau})^{*\checkmark}$	`\Sigmaptr`	$\frown$	`\roundcat`	$\Downarrow$	`\data`, `\values`
$\leq$	`\prefix`	$\geq$	`\suffix`		

4 Operators

Table 4: Symbols for CSP operators

$\rightarrow$	`\then`	$\swarrow$	`\transfer`
$\longrightarrow$	`\longthen`	$\swarrow\{x\}$	`\transfer[x]`
$\mid$	`\barchoice`	$\Box$	`\extchoice`
$\Big\mid$	`\clause`	$\Big\Box$	`\Extchoice`
$\triangleright$	`\timeout`	$\sqcap$	`\intchoice`
$\triangleright_x$	`\timeout[x]`	$\Big\sqcap$	`\Intchoice`
$\triangleleft b \triangleright$	`\cond{b}`	$\backslash\backslash$	`\view`
if	`\If`	$[\![R]\!]$	`\rename[R]`
then	`\Then`	$[\![^a/_b]\!]$	`\rensubs{`a`}{`b`}`
else	`\Else`	$[^a/_b]$	`\subs{`a`}{`b`}`
$\backslash$	`\hide`	$\gg$	`\chain`
$\parallel$	`\parallel`[c]	$\underset{X}{\parallel}$	`\parallel[X]`
$\mid\mid\mid$	`\interleave`	$_X\parallel_Y$	`\parallel[X][Y]`
$\Big\parallel$	`\Parallel`	$\underset{X}{\Big\parallel}$	`\Parallel[X]`
$\Big\mid\Big\mid\Big\mid$	`\Interleave`	$/\!\!/$	`\enslave`
$\mu\, p.P$	`\rec{p}{P}`	$/\!\!/_X$	`\enslave[X]`
let	`\Let`	;	`;`[d]
within	`\Within`	@	`\at`

[c] The `\parallel` command has been overridden to produce the symbol for divergent CSP processes. The standard LaTeX parallel symbol $\parallel$ can be obtained by using the `\xparallel` command

[d] The standard semicolon character has been modified into a binary relation symbol to produce the CSP sequential composition symbol in maths mode. The semicolon symbol in text mode is unchanged. The standard semicol symbol can be used in maths mode using the `\semicolon` command.

5 Semantic Models and Refinment

Table 5: Symbols for denotational semantics and refinement

$\sqsubseteq$	`\refinedby`	*semantics*	`\semantics`
$\sqsubseteq_x$	`\refinedby[x]`[e]	*initials*	`\initials`
$\sqsubseteq_{\mathrm{T}}$	`\trefinedby`	*acceptances*	`\acceptances`
$\sqsubseteq_{\mathrm{F}}$	`\frefinedby`	*refusals*	`\refusals`
$\sqsubseteq_{\mathrm{FD}}$	`\fdrefinedby`	*deadlocks*	`\deadlocks`
$\sqsubseteq_{\mathrm{A}}$	`\arefinedby`	*divergences*	`\divergences`
$\sqsubseteq_{\mathrm{FL}}$	`\flrefinedby`	*traces*	`\traces`
$\sqsubseteq_{\mathrm{U}}$	`\urefinedby`	$traces_{\perp}$	`\dtraces`
$\sqsubseteq_{\mathrm{R}}$	`\rrefinedby`	*Traces*	`\Traces`
$\sqsubseteq_{\mathrm{RT}}$	`\rtefinedby`	$Traces_{\perp}$	`\DTraces`
$\sqsupseteq$	`\refines`	*failures*	`\failures`
$\sqsupseteq_x$	`\refines[x]`[e]	$failures_{\perp}$	`\dfailures`
$\sqsupseteq_{\mathrm{T}}$	`\trefines`	*infinites*	`\infinites`
$\sqsupseteq_{\mathrm{F}}$	`\frefines`	$infinites_{\perp}$	`\dinfinites`
$\sqsupseteq_{\mathrm{FD}}$	`\fdrefines`	*refusal traces*	`\refusaltraces`
$\sqsupseteq_{\mathrm{A}}$	`\arefines`	*revivals*	`\revivals`
$\sqsupseteq_{\mathrm{FL}}$	`\flrefines`	*timed traces*	`\timedtraces`
$\sqsupseteq_{\mathrm{U}}$	`\urefines`	*timed failures*	`\timedfailures`
$\sqsupseteq_{\mathrm{R}}$	`\rrefines`	*timed divergences*	`\timeddivergences`
$\sqsupseteq_{\mathrm{RT}}$	`\rtrefines`	*FLO*	`\FLO`
$\equiv_{\mathrm{T}}$	`\tequiv`	$\overline{model}$	`\semclosure{model}`
$\equiv_{\mathrm{F}}$	`\fequiv`	**sat**	`\sat`
$\equiv_{\mathrm{FD}}$	`\fdequiv`	$[\![$	`\leftsemb`
$\equiv_{\mathrm{A}}$	`\aequiv`	$]\!]$	`\rightsemb`
$\equiv_{\mathrm{FL}}$	`\flequiv`	$[\![x]\!]$	`\semb{x}`
$\equiv_{\mathrm{U}}$	`\uequiv`	$[x]_\bullet$	`\nrel{x}`
$\equiv_{\mathrm{R}}$	`\requiv`	$\equiv_{\mathrm{RT}}$	`\rtequiv`

[e] It is debatable whether the correct symbol for refinement in a given semantic model $\mathcal{M}$ is $\sqsubseteq_{\mathrm{M}}$ (CSP_M-inspired style, more popular) or $\sqsubseteq_{\mathcal{M}}$ (more suitable for "blackboard" CSP). The `\refineby[x]` and `\refines[x]` macros can be used for the latter style of symbols for refinement and anti-refinement, respectively; x can be replaced with any of the model names from Table 7.

6 Transitions

Table 6: Symbols for operational semantics

$\rightsquigarrow$	`\twidtrans`	$\overset{x}{\rightsquigarrow}$	`\twidtrans[x]`	$\overset{x}{\rightsquigarrow}_y$	`\twidtrans[x][y]`
$\longrightarrow$	`\trans`	$\overset{x}{\longrightarrow}$	`\trans[x]`	$\overset{x}{\longrightarrow}_y$	`\trans[x][y]`
$\rightarrow$	`\trans(1)`	$\overset{x}{\rightarrow}$	`\trans(1)[x]`	$\overset{x}{\rightarrow}_y$	`\trans(1)[x][y]`
$\longrightarrow$	`\trans(2)`	$\overset{x}{\longrightarrow}$	`\trans(2)[x]`	$\overset{x}{\longrightarrow}_y$	`\trans(2)[x][y]`
$\longrightarrow$	`\trans(3)`	$\overset{x}{\longrightarrow}$	`\trans(3)[x]`	$\overset{x}{\longrightarrow}_y$	`\trans(3)[x][y]`
$\longrightarrow$	`\trans(4)`	$\overset{x}{\longrightarrow}$	`\trans(4)[x]`	$\overset{x}{\longrightarrow}_y$	`\trans(4)[x][y]`
	...		...		...
$\longmapsto$	`\mapstotrans`	$\overset{x}{\longmapsto}$	`\mapstotrans[x]`	$\overset{x}{\longmapsto}_y$	`\mapstotrans[x][y]`
$\mapsto$	`\mapstotrans(1)`	$\overset{x}{\mapsto}$	`\mapstotrans(1)[x]`	$\overset{x}{\mapsto}_y$	`\mapstotrans(1)[x][y]`
$\longmapsto$	`\mapstotrans(2)`	$\overset{x}{\longmapsto}$	`\mapstotrans(2)[x]`	$\overset{x}{\longmapsto}_y$	`\mapstotrans(2)[x][y]`
$\longmapsto$	`\mapstotrans(3)`	$\overset{x}{\longmapsto}$	`\mapstotrans(3)[x]`	$\overset{x}{\longmapsto}_y$	`\mapstotrans(3)[x][y]`
$\longmapsto$	`\mapstotrans(4)`	$\overset{x}{\longmapsto}$	`\mapstotrans(4)[x]`	$\overset{x}{\longmapsto}_y$	`\mapstotrans(4)[x][y]`
	...		...		...
$\Longrightarrow$	`\Trans`	$\overset{x}{\Longrightarrow}$	`\Trans[x]`	$\overset{x}{\Longrightarrow}_y$	`\Trans[x][y]`
$\Rightarrow$	`\Trans(1)`	$\overset{x}{\Rightarrow}$	`\Trans(1)[x]`	$\overset{x}{\Rightarrow}_y$	`\Trans(1)[x][y]`
$\Longrightarrow$	`\Trans(2)`	$\overset{x}{\Longrightarrow}$	`\Trans(2)[x]`	$\overset{x}{\Longrightarrow}_y$	`\Trans(2)[x][y]`
$\Longrightarrow$	`\Trans(3)`	$\overset{x}{\Longrightarrow}$	`\Trans(3)[x]`	$\overset{x}{\Longrightarrow}_y$	`\Trans(3)[x][y]`
$\Longrightarrow$	`\Trans(4)`	$\overset{x}{\Longrightarrow}$	`\Trans(4)[x]`	$\overset{x}{\Longrightarrow}_y$	`\Trans(4)[x][y]`
	...		...		...
$\Longrightarrow\!\!\bullet$	`\ugr`	$\overset{x}{\Longrightarrow}\!\!\bullet$	`\ugr[x]`	$\overset{x}{\Longrightarrow}\!\!\bullet_y$	`\ugr[x][y]`
$\Rightarrow\!\!\bullet$	`\ugr(1)`	$\overset{x}{\Rightarrow}\!\!\bullet$	`\ugr(1)[x]`	$\overset{x}{\Rightarrow}\!\!\bullet_y$	`\ugr(1)[x][y]`
$\Longrightarrow\!\!\bullet$	`\ugr(2)`	$\overset{x}{\Longrightarrow}\!\!\bullet$	`\ugr(2)[x]`	$\overset{x}{\Longrightarrow}\!\!\bullet_y$	`\ugr(2)[x][y]`
$\Longrightarrow\!\!\bullet$	`\ugr(3)`	$\overset{x}{\Longrightarrow}\!\!\bullet$	`\ugr(3)[x]`	$\overset{x}{\Longrightarrow}\!\!\bullet_y$	`\ugr(3)[x][y]`
$\Longrightarrow\!\!\bullet$	`\ugr(4)`	$\overset{x}{\Longrightarrow}\!\!\bullet$	`\ugr(4)[x]`	$\overset{x}{\Longrightarrow}\!\!\bullet_y$	`\ugr(4)[x][y]`
	...		...		...
$\longrightarrow^*$	`\starit{\trans}`[f]	$\overset{x}{\longrightarrow}^*$	`\starit{\trans}[x]`[f]	$\overset{x}{\longrightarrow}^*_y$	`\starit{\trans}[x][y]`[f]

[f] The `\trans` command can be replaced by any other macro for generating a transiton arrow from the left-hand column of this table.

N.B. Increasing the length argument (the number inside the round brackets) of any transition macro lengthens the arrow by 0.6em.

7 Semantics models, spaces and functions

Table 7: Symbols for semantic models, spaces and functions

$\mathcal{T}$	`\tmodel`	$\mathcal{F}$	`\fmodel`	$\mathcal{N}$	`\nmodel`
$\mathcal{T}_x$	`\tmodel[x]`	$\mathcal{F}_x$	`\fmodel[x]`	$\mathcal{N}$	`\nmodel[x]`
$\mathcal{A}$	`\amodel`	$\mathcal{FL}$	`\flmodel`	$\mathcal{U}$	`\umodel`
$\mathcal{A}_x$	`\amodel[x]`	$\mathcal{FL}_x$	`\flmodel[x]`	$\mathcal{U}_x$	`\umodel[x]`
$\mathcal{R}$	`\rmodel`	$\mathcal{RT}$	`\rtmodel`	$\mathcal{M}$	`\mmodel`
$\mathcal{R}_x$	`\rmodel[x]`	$\mathcal{RT}_x$	`\rtmodel[x]`	$\mathcal{M}_x$	`\mmodel[x]`
$x^{\Downarrow}$	`\sdiv{x}`	$\preceq$	`\identrel`		

8 Other symbols

Table 8: Other useful symbols

CSP_M	`\CSPM{}`[g]	$\widehat{=}$	`\defs`
ref	`\refuses`	$\lambda\, x.y$	`\lambdaexpr{x}{y}`
div	`\diverges`		

[g] This macro works only in text mode. The curly brackets are needed as otherwise LaTeX does not produce enough white space after the symbol.