

Circus-L^AT_EX style explained

Community Z Tools (CZT)

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Contents

A	Environments	3
A.1	Informal argument	3
B	Reference card	4
B.1	Special <i>Circus</i> symbols	4
	Refinement	4
B.2	<i>Circus</i> channels and name sets	4
B.3	<i>Circus</i> actions	4
	Action definition	4
	Basic actions	4
	Prefixing action	4
	Prefixing action (extra)	5
	Unary actions	5
	Binary actions	5
	Replicated actions	5
	Parenthesised actions	6
B.4	<i>Circus</i> command definitions	6
	Guarded commands	6
	Parameterised commands	6
B.5	<i>Circus</i> processes	7
	Process definition	7
	Basic process	7
	Unary processes	7
	Binary processes	7

	Parameterised and indexed processes	7
	Parenthesised processes	8
	Replicated processes	8
B.6	Mathematical toolkits	8
	<i>Circus</i> prelude	8
	<i>Circus</i> model checking toolkit	8
	<i>Circus</i> Spivey's Z bag toolkit	8

List of Tables

* PARSER DOES NOT YET SUPPORT LOGICAL CONSTANTS

A Environments

A.1 Informal argument

To typeset an informal argument, you write in \LaTeX

```
\begin{argue}
  S \dres (T \dres R) \\\
\t1      = \id S \comp \id T \comp R \\\
\t1      = \id (S \cap T) \comp R & \text{law about } \$\id$ \\\
\t1 = (S \cap T) \dres R.
\end{argue}
```

which corresponds to

$$\begin{aligned}
 S \triangleleft (T \triangleleft R) \\
 &= \text{id } S \mathbin{\text{\textcircled{;}}} \text{id } T \mathbin{\text{\textcircled{;}}} R \\
 &= \text{id}(S \cap T) \mathbin{\text{\textcircled{;}}} R && [\text{law about id}] \\
 &= (S \cap T) \triangleleft R.
 \end{aligned}$$

B Reference card

B.1 Special *Circus* symbols

Refinement

$n \Vdash S = I$	$n \text{ \texttt{\textbackslash circassertref } } S = I$
$n \Vdash S \preceq I$	$n \text{ \texttt{\textbackslash circassertref } } S \text{ \texttt{\textbackslash circsimulates } } I$
$n \Vdash S \sqsubseteq I$	$n \text{ \texttt{\textbackslash circassertref } } S \text{ \texttt{\textbackslash circrefines } } I$
$n \Vdash S \sqsubseteq Tr\ I$	$n \text{ \texttt{\textbackslash circassertref } } S \text{ \texttt{\textbackslash circrefines } } Tr\ I$
$n \Vdash S \sqsubseteq SFl\ I$	$n \text{ \texttt{\textbackslash circassertref } } S \text{ \texttt{\textbackslash circrefines } } SFl\ I$
$n \Vdash S \sqsubseteq FLDv\ I$	$n \text{ \texttt{\textbackslash circassertref } } S \text{ \texttt{\textbackslash circrefines } } FLDv\ I$

B.2 *Circus* channels and name sets

<u><i>channel</i></u> e	$\text{\texttt{\textbackslash circchannel } } e$
<u><i>channel</i></u> $c : T$	$\text{\texttt{\textbackslash circchannel } } c : T$
<u><i>channel</i></u> $[X]c : X$	$\text{\texttt{\textbackslash circchannel } } [X] c : X$
<u><i>channelfrom</i></u> S	$\text{\texttt{\textbackslash circchannelfrom } } S$
<u><i>channelfrom</i></u> $[X]S[X]$	$\text{\texttt{\textbackslash circchannelfrom } } [X] S[X]$
<u><i>channelset</i></u> $n == \{ c \}$	$\text{\texttt{\textbackslash circchannelset } } n == \text{\texttt{\textbackslash lchanset } } c \text{ \texttt{\textbackslash rchanset } }$
<u><i>channelset</i></u> $n == CSRef$	$\text{\texttt{\textbackslash circchannelset } } n == CS$
<u><i>channelset</i></u> $[X]n == CSRef$	$\text{\texttt{\textbackslash circchannelset } } [X] n == CS$
<u><i>nameset</i></u> $n == \{ x \}$	$\text{\texttt{\textbackslash circnameset } } n == \{ \sim x \sim \}$
<u><i>nameset</i></u> $n == NSRef$	$\text{\texttt{\textbackslash circnameset } } n == NS$

B.3 *Circus* actions

Action definition

$n \hat{=} A$	$n \text{ \texttt{\textbackslash circdef } } A$
$n \hat{=} x : T \bullet A$	$n \text{ \texttt{\textbackslash circdef } } x : T \text{ \texttt{\textbackslash circspot } } A$

Basic actions

<u><i>Skip</i></u>	$\text{\texttt{\textbackslash Skip}}$
<u><i>Stop</i></u>	$\text{\texttt{\textbackslash Stop}}$
<u><i>Chaos</i></u>	$\text{\texttt{\textbackslash Chaos}}$

Prefixing action

$e \longrightarrow A$	$e \text{ \texttt{\textbackslash then } } A$
$c.0 \longrightarrow A$	$c.0 \text{ \texttt{\textbackslash then } } A$
$c!v \longrightarrow A$	$c!v \text{ \texttt{\textbackslash then } } A$
$c?x \longrightarrow A$	$c?x \text{ \texttt{\textbackslash then } } A$
$c?x!y?z \longrightarrow A$	$c?x!y?z \text{ \texttt{\textbackslash then } } A$

Prefixing action (extra)

$c?x : (P)!(f\ x) \longrightarrow A$
 $c?x \backslash \text{prefixcolon} (P)!(f\sim x) \backslash \text{then } A$
 $c?x : (x > 1)!(f\ x) \longrightarrow A$
 $c?x \backslash \text{prefixcolon} (x > 1)!(f\sim x) \backslash \text{then } A$
 $c[\mathbb{N} \times \mathbb{P}\ \mathbb{N}]?x!(\text{dom } R) \longrightarrow A$
 $c[\backslash \text{nat} \backslash \text{cross} \backslash \text{power}\sim \backslash \text{nat}]?x!(\backslash \text{dom}\sim R) \backslash \text{then } A$

Unary actions

(S) $\backslash \text{lschexpract } S \backslash \text{rschexpract}$
 $\mu X \bullet A$ $\backslash \text{circmu } X \backslash \text{circspot } A$
 $A \backslash CS$ $A \backslash \text{circhide } CS$
 $(P) \& A$ $\backslash \text{lcircguard } P \backslash \text{rcircguard } \backslash \text{circguard } A$

Binary actions

$A \parallel NSa \mid NSb \parallel B$ $A \backslash \text{linter } NSa \mid NSb \backslash \text{rinter } B$
 $A \parallel B$ $A \backslash \text{interleave } B$
 $A \parallel NSa \mid CS \mid NSb \parallel B$ $A \backslash \text{lpar } NSa \mid CS \mid NSb \backslash \text{rpar } B$
 $A \parallel CS \parallel B$ $A \backslash \text{lpar } CS \backslash \text{rpar } B$
 $A[NSb \mid CSa \mid CSb \mid NSb]B$ $A \text{ [} NSb \mid CSa \mid CSb \mid NSb \text{] } B$
 $A[CSa \mid CSb]B$ $A \text{ [} CSa \mid CSb \text{] } B$
 $A \sqcap B$ $A \backslash \text{intchoice } B$
 $A \square B$ $A \backslash \text{extchoice } B$
 $A ; B$ $A \backslash \text{circseq } B$
 $AName$ $AName$
 $AName(x, y)$ $AName(x, y)$
 $AName[\text{new}/\text{old}, x/y]$ $AName[\text{new}/\text{old}, x/y]$

Replicated actions

$\parallel x : T \bullet A$ $\backslash \text{Interleave } x : T \backslash \text{circspot } A$
 $\parallel x : T \parallel NS \bullet A$ $\backslash \text{Interleave } x : T \backslash \text{linter } NS \backslash \text{rinter } \backslash \text{circspot } A$
 $\parallel CS \parallel x : T \bullet \parallel NS \parallel A$ $\backslash \text{lpar } CS \backslash \text{rpar } x : T \backslash \text{circspot } \backslash \text{lpar } NS \backslash \text{rpar } A$
 $\parallel CS \parallel x : T \bullet A$ $\backslash \text{lpar } CS \backslash \text{rpar } x : T \backslash \text{circspot } A$
 $\sqcap x : T \bullet A$ $\backslash \text{Intchoice } x : T \backslash \text{circspot } A$

$\Box x : T \bullet A$	<code>\Extchoice x : T \circspot A</code>
$\dot{;} x : T \bullet A$	<code>\Semi x : T \circspot A</code>

Parenthesised actions

(A)	<code>(A)</code>
$(x : T \bullet A)$	<code>(x : T \circspot A)</code>
$(\underline{\mathbf{val}} x : T \bullet A)$	<code>(\circval x : T \circspot A)</code>
$(\underline{\mathbf{res}} x : T \bullet A)$	<code>(\circres x : T \circspot A)</code>
$(\underline{\mathbf{vres}} x : T \bullet A)$	<code>(\circvres x : T \circspot A)</code>
$(x : T \bullet A)(v)$	<code>(x : T \circspot A)(v)</code>
$(\underline{\mathbf{val}} x : T \bullet A)(v)$	<code>(\circval x : T \circspot A)(v)</code>
$(\underline{\mathbf{res}} x : T \bullet A)(v)$	<code>(\circres x : T \circspot A)(v)</code>
$(\underline{\mathbf{vres}} x : T \bullet A)(v)$	<code>(\circvres x : T \circspot A)(v)</code>
$(\mu X \bullet x : T \bullet A)(v)$	<code>(\circmu X \circspot x : T \circspot A)(v)</code>
$(\mu X \bullet (x : T \bullet A))(v)$	<code>(\circmu X \circspot (x : T \circspot A))(v)</code>
$(\mu X \bullet \underline{\mathbf{val}} x : T \bullet A)(v)$	<code>(\circmu X \circspot \circval x : T \circspot A)(v)</code>
$(\mu X \bullet \underline{\mathbf{res}} x : T \bullet A)(v)$	<code>(\circmu X \circspot \circres x : T \circspot A)(v)</code>
$(\mu X \bullet \underline{\mathbf{vres}} x : T \bullet A)(v)$	<code>(\circmu X \circspot \circvres x : T \circspot A)(v)</code>

B.4 Circus command definitions

Guarded commands

$x, y := v1, v2$	<code>x, y := v1, v2</code>
$x, y : [P, Q]$	<code>x, y \prefixcolon [~ P, Q ~]</code>
$: [P, Q]$	<code>\prefixcolon [~ P, Q ~]</code>
$\{P\}$	<code>\{~ P ~\}</code>
$[P]$	<code>[~ P ~]</code>
$\underline{\mathbf{if}} P \longrightarrow A \parallel B \underline{\mathbf{fi}}$	<code>\circif P \circrthen A \circelse B \circffi</code>
$\underline{\mathbf{do}} P \longrightarrow A \underline{\mathbf{od}}$	<code>\circdo P \circrthen A \circcod</code>
$\underline{\mathbf{con}} X \bullet A$	<code>\circcon X \circspot A</code>
$\underline{\mathbf{var}} x : T \bullet A$	<code>\circvar x : T \circspot A</code>

Parameterised commands

$\underline{\mathbf{val}} x : T \bullet A$	<code>\circval x : T \circspot A</code>
$\underline{\mathbf{res}} x : T \bullet A$	<code>\circres x : T \circspot A</code>

$\underline{vres} x : T \bullet A$ $\backslash\text{circvres } x : T \backslash\text{circspot } A$

B.5 Circus processes

Process definition

$\underline{process} n \hat{=} PD$ $\backslash\text{circprocess } n \backslash\text{circdef } PD$
 $\underline{process}[X]n \hat{=} PD$ $\backslash\text{circprocess } [X] n \backslash\text{circdef } PD$

Basic process

$\underline{process} n \hat{=} \underline{begin} \dots BP \dots \underline{end}$
 $\backslash\text{circprocess } n \backslash\text{circdef } \backslash\text{circbegin } \backslash\text{ldots } BP \backslash\text{ldots } \backslash\text{circend}$
 $\underline{state} n == S$ $\backslash\text{circstate } n == S$
 $\underline{state} S$ $\backslash\text{circstate } S$

Unary processes

$P \setminus CS$ $P \backslash\text{circhide } CS$
 $PName$ $PName$
 $PName[\mathbb{N}]$ $PName[\backslash\text{nat}]$
 $PName(x, y)$ $PName(x, y)$
 $PName[\mathbb{N}](x, y)$ $PName[\backslash\text{nat}](x, y)$
 $PName[x]$ $PName \backslash\text{lcircindex } x \backslash\text{rcircindex}$
 $PName[\mathbb{N}][x]$ $PName[\backslash\text{nat}] \backslash\text{lcircindex } x \backslash\text{rcircindex}$
 $PName[c, d := e, f]$ $PName \backslash\text{lcircrename } c, d := e, f \backslash\text{rcircrename}$
 $PName[\mathbb{N}][c, d := e, f]$ $PName[\backslash\text{nat}] \backslash\text{lcircrename } c, d := e, f \backslash\text{rcircrename}$

Binary processes

$P \parallel Q$ $P \backslash\text{interleave } Q$
 $P \llbracket CS \rrbracket Q$ $P \backslash\text{lpar } CS \backslash\text{rpar } Q$
 $P \sqcap Q$ $P \backslash\text{intchoice } Q$
 $P \sqcup Q$ $P \backslash\text{extchoice } Q$
 $P ; Q$ $P \backslash\text{circseq } Q$

Parameterised and indexed processes

$x : T \bullet P$ $x : T \backslash\text{circspot } P$
 $x : T \odot P$ $x : T \backslash\text{circindex } P$

Parenthesised processes

(P)	(P)
$(x : T \bullet P)$	$(x : T \backslash \text{circspot } P)$
$(x : T \odot P)$	$(x : T \backslash \text{circindex } P)$
$(P)[c := d]$	$(P) \backslash \text{lcircrename } c := d \backslash \text{rcircrename}$
$(x : T \bullet P)[c := d]$	$(x : T \backslash \text{circspot } P) \backslash \text{lcircrename } c := d \backslash \text{rcircrename}$
$(x : T \odot P)[c := d]$	$(x : T \backslash \text{circindex } P) \backslash \text{lcircrename } c := d \backslash \text{rcircrename}$
$(x : T \bullet P)(v)$	$(x : T \backslash \text{circspot } P)(v)$
$(x : T \odot P)(v)$	$(x : T \backslash \text{circindex } P)(v)$
$[X](x : X \bullet P)[\mathbb{N}](1)$	$[X](x : X \backslash \text{circspot } P)[\backslash \text{nat}](1)$
$[X](x : X \odot P)[\mathbb{N}](1)$	$[X](x : X \backslash \text{circindex } P)[\backslash \text{nat}](1)$
$(\mu X \bullet x : T \bullet P)(v)$	$(\backslash \text{circmu } X \backslash \text{circspot } x : T \backslash \text{circspot } P)(v)$
$(\mu X \bullet (x : T \bullet P))(v)$	$(\backslash \text{circmu } X \backslash \text{circspot } (x : T \backslash \text{circspot } P))(v)$
$(\mu X \bullet \underline{\text{val}} x : T \bullet P)(v)$	$(\backslash \text{circmu } X \backslash \text{circspot } \backslash \text{circval } x : T \backslash \text{circspot } P)(v)$

Replicated processes

$ x : T \bullet P$	$\backslash \text{Interleave } x : T \backslash \text{circspot } P$
$ x : T \llbracket CS \rrbracket \bullet P$	$\backslash \text{Parallel } x : T \backslash \text{lpar } CS \backslash \text{rpar } \backslash \text{circspot } P$
$\sqcap x : T \bullet P$	$\backslash \text{Intchoice } x : T \backslash \text{circspot } P$
$\square x : T \bullet P$	$\backslash \text{Extchoice } x : T \backslash \text{circspot } P$
$; x : T \bullet P$	$\backslash \text{Semi } x : T \backslash \text{circspot } P$

B.6 Mathematical toolkits $SS \diamond S$ $SS \backslash \text{dcap } S$

Circus prelude

\mathbb{B}	$\backslash \text{boolean}$
\mathbb{U}	$\backslash \text{universe}$
$\underline{\text{True}}$	$\backslash \text{true}$
$\underline{\text{False}}$	$\backslash \text{false}$

Circus model checking toolkit

$SS \bowtie TT$	$SS \backslash \text{gendj } TT$
$\otimes SS$	$\backslash \text{regions } SS$
$SS \searrow S$	$SS \backslash \text{dsetminus } S$

Circus Spivey's Z bag toolkit

$\text{bag } X$	$\backslash \text{bag} \sim X$
$B \# n$	$B \backslash \text{bcount } n$
$n \otimes B$	$n \backslash \text{otimes } B$
$B \uplus C$	$B \backslash \text{uplus } C$
$B \uplus C$	$B \backslash \text{uminus } C$
$x \in B$	$x \backslash \text{inbag } B$
$B \sqsubseteq C$	$B \backslash \text{subbageq } C$
$\llbracket x, y \rrbracket$	$\backslash \text{lbag } x, y \backslash \text{rbag}$

References