Circus-LaTeX style explained
Community Z Tools (CZT)

Leo Freitas
leo@cs.york.ac.uk

Department of Computer Science
University of York, YO10 5DD
York, United Kingdom

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

which corresponds to

$$\begin{aligned}
&S \lhd (T \lhd R) \\
&\quad = \mathrm{id}\, S \fatsemi \mathrm{id}\, T \fatsemi R \\
&\quad = \mathrm{id}(S \cap T) \fatsemi R && \text{[law about id]} \\
&\quad = (S \cap T) \lhd R.
\end{aligned}$$

B Reference card

B.1 Special *Circus* symbols

Refinement

$n \Vdash S = I$	`n \circassertref S = I`
$n \Vdash S \preccurlyeq I$	`n \circassertref S \circsimulates I`
$n \Vdash S \sqsubseteq I$	`n \circassertref S \circrefines I`
$n \Vdash S \sqsubseteq \mathit{Tr}\ I$	`n \circassertref S \circrefines Tr~ I`
$n \Vdash S \sqsubseteq \mathit{SFl}\ I$	`n \circassertref S \circrefines SFl~ I`
$n \Vdash S \sqsubseteq \mathit{FlDv}\ I$	`n \circassertref S \circrefines FlDv~ I`

B.2 *Circus* channels and name sets

$\mathbf{channel}\, e$	`\circchannel e`
$\mathbf{channel}\, c : T$	`\circchannel c : T`
$\mathbf{channel}[X] c : X$	`\circchannel [X] c : X`
$\mathbf{channelfrom}\, S$	`\circchannelfrom S`
$\mathbf{channelfrom}[X] S[X]$	`\circchannelfrom [X] S[X]`
$\mathbf{channelset}\, n == \{\!\mid c \mid\!\}$	`\circchannelset n == \lchanset c \rchanset`
$\mathbf{channelset}\, n == \mathit{CSRef}$	`\circchannelset n == CS`
$\mathbf{channelset}[X] n == \mathit{CSRef}$	`\circchannelset [X] n == CS`
$\mathbf{nameset}\, n == \{\, x \,\}$	`\circnameset n == \{~ x ~\}`
$\mathbf{nameset}\, n == \mathit{NSRef}$	`\circnameset n == NS`

B.3 *Circus* actions

Action definition

$n \mathrel{\widehat=} A$	`n \circdef A`
$n \mathrel{\widehat=} x : T \bullet A$	`n \circdef x: T \circspot A`

Basic actions

Skip	`\Skip`
Stop	`\Stop`
Chaos	`\Chaos`

Prefixing action

$e \longrightarrow A$	`e \then A`
$c.0 \longrightarrow A$	`c.0 \then A`
$c!v \longrightarrow A$	`c!v \then A`
$c?x \longrightarrow A$	`c?x \then A`
$c?x!y?z \longrightarrow A$	`c?x!y?z \then A`

Prefixing action (extra)

$c?x : (P)!(f\;x) \longrightarrow A$

```
c?x \prefixcolon (P)!(f~x) \then A
```

$c?x : (x > 1)!(f\;x) \longrightarrow A$

```
c?x \prefixcolon (x > 1)!(f~x) \then A
```

$c[\mathbb{N} \times \mathbb{P}\;\mathbb{N}]?x!(\mathrm{dom}\;R) \longrightarrow A$

```
c[\nat \cross \power~\nat]?x!(\dom~R) \then A
```

Unary actions

$\big(S\big)$	`\lschexpract S \rschexpract`
$\mu X \bullet A$	`\circmu X \circspot A`
$A \setminus CS$	`A \circhide CS`
$\big(P\big) \mathbin{\&} A$	`\lcircguard P \rcircguard \circguard A`

Binary actions

$A \;\vert\!\vert\!\vert\![\; NSa \mid NSb \;]\!\vert\!\vert\!\vert\; B$	`A \linter NSa | NSb \rinter B`
$A \;\vert\!\vert\!\vert\; B$	`A \interleave B`
$A \;[\![\; NSa \mid CS \mid NSb \;]\!]\; B$	`A \lpar NSa | CS | NSb \rpar B`
$A \;[\![\; CS \;]\!]\; B$	`A \lpar CS \rpar B`
$A[NSb \mid CSa \mid CSb \mid NSb]B$	`A [ NSb | CSa | CSb | NSb ] B`
$A[CSa \mid CSb]B$	`A [ CSa | CSb ] B`
$A \sqcap B$	`A \intchoice B`
$A \mathbin{\Box} B$	`A \extchoice B`
$A \;;\; B$	`A \circseq B`
$AName$	`AName`
$AName(x, y)$	`AName(x, y)`
$AName[new/old, x/y]$	`AName[new/old, x/y]`

Replicated actions

$\Big\vert\!\Big\vert\!\Big\vert\; x : T \bullet A$	`\Interleave x: T \circspot A`
$\Big\vert\!\Big\vert\!\Big\vert\; x : T \;\vert\!\vert\!\vert\![\; NS]\!\vert\!\vert\!\vert \bullet A$	`\Interleave x: T \linter NS \rinter \circspot A`
$[\![CS\;]\!]\; x : T \bullet [\![NS\;]\!]\; A$	`\lpar CS \rpar x: T \circspot \lpar NS \rpar A`
$[\![CS\;]\!]\; x : T \bullet A$	`\lpar CS \rpar x: T \circspot A`
$\bigsqcap x : T \bullet A$	`\Intchoice x : T \circspot A`

$\Box\, x : T \bullet A$	`\Extchoice x : T \circspot A`
$\mathop{;}\ x : T \bullet A$	`\Semi x : T \circspot A`

Parenthesised actions

(A)	`(A)`
$(x : T \bullet A)$	`(x : T \circspot A)`
$(\mathbf{val}\, x : T \bullet A)$	`(\circval x : T \circspot A)`
$(\mathbf{res}\, x : T \bullet A)$	`(\circres x : T \circspot A)`
$(\mathbf{vres}\, x : T \bullet A)$	`(\circvres x : T \circspot A)`
$(x : T \bullet A)(v)$	`(x : T \circspot A)(v)`
$(\mathbf{val}\, x : T \bullet A)(v)$	`(\circval x : T \circspot A)(v)`
$(\mathbf{res}\, x : T \bullet A)(v)$	`(\circres x : T \circspot A)(v)`
$(\mathbf{vres}\, x : T \bullet A)(v)$	`(\circvres x : T \circspot A)(v)`
$(\mu X \bullet x : T \bullet A)(v)$	`(\circmu X \circspot x : T \circspot A)(v)`
$(\mu X \bullet (x : T \bullet A))(v)$	`(\circmu X \circspot (x : T \circspot A))(v)`
$(\mu X \bullet \mathbf{val}\, x : T \bullet A)(v)$	`(\circmu X \circspot \circval x : T \circspot A)(v)`
$(\mu X \bullet \mathbf{res}\, x : T \bullet A)(v)$	`(\circmu X \circspot \circres x : T \circspot A)(v)`
$(\mu X \bullet \mathbf{vres}\, x : T \bullet A)(v)$	`(\circmu X \circspot \circvres x : T \circspot A)(v)`

B.4 *Circus* command definitions

Guarded commands

$x, y := v1, v2$	`x, y := v1, v2`
$x, y : [\, P, Q\,]$	`x, y \prefixcolon [~ P, Q ~]`
$:[\, P, Q\,]$	`\prefixcolon [~ P, Q ~]`
$\{\, P\,\}$	`\{~ P ~\}`
$[\, P\,]$	`[~ P ~]`
$\mathbf{if}\ P \longrightarrow A \mathrel{[\!]} B\ \mathbf{fi}$	`\circif P \circthen A \circelse B \circfi`
$\mathbf{do}\ P \longrightarrow A\ \mathbf{od}$	`\circdo P \circthen A \circod`
$\mathbf{con}\, X \bullet A$	`\circcon X \circspot A`
$\mathbf{var}\, x : T \bullet A$	`\circvar x : T \circspot A`

Parameterised commands

$\mathbf{val}\, x : T \bullet A$	`\circval x : T \circspot A`
$\mathbf{res}\, x : T \bullet A$	`\circres x : T \circspot A`

$\mathbf{vres}\, x : T \bullet A$	`\circvres x : T \circspot A`

B.5 *Circus* processes

Process definition

$\mathbf{process}\, n \mathrel{\widehat{=}} PD$	`\circprocess n \circdef PD`
$\mathbf{process}[X]n \mathrel{\widehat{=}} PD$	`\circprocess [X] n \circdef PD`

Basic process

$\mathbf{process}\, n \mathrel{\widehat{=}} \mathbf{begin} \ldots BP \ldots \mathbf{end}$	`\circprocess n \circdef \circbegin \ldots BP \ldots  \circend`
$\mathbf{state}\, n == S$	`\circstate n == S`
$\mathbf{state}\, S$	`\circstate S`

Unary processes

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

Binary processes

$P \vert\vert\vert Q$	`P \interleave Q`
$P \llbracket CS \rrbracket Q$	`P \lpar CS \rpar Q`
$P \sqcap Q$	`P \intchoice Q`
$P \Box Q$	`P \extchoice Q`
$P \ ;\ Q$	`P \circseq Q`

Parameterised and indexed processes

$x : T \bullet P$	`x : T \circspot P`
$x : T \odot P$	`x : T \circindex P`

Parenthesised processes

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

Replicated processes

$\vert\vert\vert\ x : T \bullet P$	`\Interleave x: T \circspot P`
$\Vert\, x : T \llbracket\, CS \rrbracket \bullet P$	`\Parallel x: T \lpar CS \rpar \circspot P`
$\bigsqcap x : T \bullet P$	`\Intchoice x : T \circspot P`
$\Box\, x : T \bullet P$	`\Extchoice x : T \circspot P`
$;\ \ x : T \bullet P$	`\Semi x : T \circspot P`

B.6 Mathematical toolkits

Circus **prelude**

$\mathbb{B}$	`\boolean`
$\mathbb{U}$	`\universe`
True	`\true`
False	`\false`

Circus **model checking toolkit**

$SS \between TT$	`SS \gendj TT`
$\otimes SS$	`\regions SS`
$SS \searrow S$	`SS \dsetminus S`
$SS \Diamond S$	`SS \dcap S`

Circus **Spivey's Z bag toolkit**

$\mathrm{bag}\ X$	`\bag~X`
$B \sharp n$	`B \bcount n`
$n \otimes B$	`n \otimes B`
$B \uplus C$	`B \uplus  C`
$B ⩁ C$	`B \uminus C`
$x \mathrel{\mathrm{E}} B$	`x \inbag B`
$B \sqsubseteq C$	`B \subbageq C`
$\llbracket x, y \rrbracket$	`\lbag x, y \rbag`