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

October 2008

Contents

List of Tables

* PARSER DOES NOT YET SUPPORT LOGICAL CONSTANTS

A Reference card

A.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`
$n \Vdash S \sqsubseteq Tr\, I$	`n \circassertref S \circrefines Tr~ I`
$n \Vdash S \sqsubseteq SFl\, I$	`n \circassertref S \circrefines SFl~ I`
$n \Vdash S \sqsubseteq FlDv\, I$	`n \circassertref S \circrefines FlDv~ I`

A.2 *Circus* channels and name sets

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

A.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`
$(P)\ \&\ A$	`\lcircguard P \rcircguard \circguard A`

Binary actions

$A \llbracket NSa \mid NSb \rrbracket B$	`A \linter NSa | NSb \rinter B`
$A \mid\mid\mid B$	`A \interleave B`
$A \lbrack\!\lbrack NSa \mid CS \mid NSb \rbrack\!\rbrack B$	`A \lpar NSa | CS | NSb \rpar B`
$A \lbrack\!\lbrack CS \rbrack\!\rbrack B$	`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`
$A \Box B$	`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`
$\Big\vert\Big\vert\Big\vert\ x : T \llbracket NS \rrbracket \bullet A$	`\Interleave x: T \linter NS \rinter \circspot A`
$\lbrack\!\lbrack CS \rbrack\!\rbrack\ x : T \bullet \lbrack\!\lbrack NS \rbrack\!\rbrack A$	`\lpar CS \rpar x: T \circspot \lpar NS \rpar A`
$\lbrack\!\lbrack CS \rbrack\!\rbrack\ x : T \bullet A$	`\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`
$\fatsemi\ x : T \bullet A$	`\Semi x : T \circspot A`

Parenthesised actions

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

A.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 ~]`
$\mathbf{\underline{if}}\, P \longrightarrow A \,[]\, B\, \mathbf{\underline{fi}}$	`\circif P \circthen A \circelse B \circfi`
$\mathbf{\underline{do}}\, P \longrightarrow A\, \mathbf{\underline{od}}$	`\circdo P \circthen A \circod`
$\mathbf{\underline{con}}\, X \bullet A$	`\circcon X \circspot A`
$\mathbf{\underline{var}}\, x : T \bullet A$	`\circvar x : T \circspot A`

Parameterised commands

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

$\underline{\textbf{\textit{vres}}}\, x : T \bullet A$	`\circvres x : T \circspot A`

A.5 *Circus* processes

Process definition

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

Basic process

$\underline{\textbf{\textit{process}}}\, n \mathrel{\widehat=} \underline{\textbf{\textit{begin}}} \ldots BP \ldots \underline{\textbf{\textit{end}}}$

```
\circprocess n \circdef \circbegin \ldots BP \ldots  \circend
```

$\underline{\textbf{\textit{state}}}\, n == S$	`\circstate n == S`
$\underline{\textbf{\textit{state}}}\, S$	`\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

$P \mid\mid\mid Q$	`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`
$P \fatsemi Q$	`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)`
$(\mu X \bullet \underline{\boldsymbol{val}}\, x : T \bullet P)(v)$	`(\circmu X \circspot \circval x : T \circspot P)(v)`

Replicated processes

$\Big\|\Big\| x : T \bullet P$	`\Interleave x: T \circspot P`
$\|\| x : T \llbracket CS \rrbracket \bullet P$	`\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`
$\fatsemi\ x : T \bullet P$	`\Semi x : T \circspot P`

A.6 Mathematical toolkits

Circus **prelude**

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

Circus **model checking toolkit**

$SS \between TT$	`SS \gendj TT`
$\otimes SS$	`\regions SS`
$SS \setminus S$	`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`
$B \sqcup C$	`B \uminus C`
$x \in B$	`x \inbag B`
$B \sqsubseteq C$	`B \subbageq C`
$[\![x, y]\!]$	`\lbag x, y \rbag`

References