Circus Cookie Machine - typechecking

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$\textbf{section}\ \ circus\_cookies\ \textbf{parents}\ \ circus\_toolkit$

$$\begin{array}{|l} cookieValue, cookieQuantity, MAX\_QUANTITY : \mathbb{N} \end{array}$$

$COOKIE ::= ok \mid notok$

$\textbf{channel}\ \ in, change : \mathbb{N}$
$\textbf{channel}\ \ out : COOKIE$

$\textbf{process}\ \ CookieMachine \mathrel{\widehat=} \textbf{begin}$

$$\begin{array}{|l} \multicolumn{1}{l}{\textit{State}} \\ \hline money, quantity : \mathbb{N} \\ \hline quantity \leq MAX\_QUANTITY \\ \hline \end{array}$$

$\textbf{state}\ \ State$

$$\begin{array}{|l} \multicolumn{1}{l}{\textit{OutputCookieOk}} \\ \hline \Delta State \\ o! : COOKIE \\ \hline money \geq cookieValue \\ quantity > 0 \\ money' = money - cookieValue \\ quantity' = quantity - 1 \\ o! = ok \\ \hline \end{array}$$

$$
\begin{array}{|l}
\multicolumn{1}{l}{\mathit{OutputCookieNotOk}}\\
\hline
\Delta \mathit{State}\\
o! : \mathit{COOKIE}\\
\hline
\mathit{money} \geq \mathit{cookieValue}\\
\mathit{quantity} = 0\\
\mathit{money}' = \mathit{money}\\
o! = \mathit{notok}\\
\hline
\end{array}
$$

It is not a total operation because there might not be enough money.

$$\mathit{OutputCookie} == \mathit{OutputCookieOk} \lor \mathit{OutputCookieNotOk}$$

Schema expressions as actions.

$$\mathit{InitState} \mathrel{\widehat=} \big([\, \mathit{State}\,' \mid \mathit{money}' = 0 \land \mathit{quantity}' = \mathit{cookieQuantity} \,] \big)$$

Note this will generate type error for *InputMoney* because $x?$ is not into scope.

The next line is not being parsed...

$$\mathit{InputMoney} \mathrel{\widehat=} \big([\, \Delta \mathit{State};\ x? : \mathbb{N} \mid \mathit{money} \leq \mathit{cookieValue} \land \mathit{money}' = \mathit{money} + x? \,] \big)$$

$$\begin{array}{l}
\mathit{InputMoney} == \\
\qquad [\, \Delta \mathit{State};\ x? : \mathbb{N} \mid \mathit{money} \leq \mathit{cookieValue} \land \mathit{money}' = \mathit{money} + x? \,]
\end{array}$$

$$\mathit{Input} \mathrel{\widehat=} (\mathit{money} \leq \mathit{cookieValue}) \mathbin{\&}\ \mathit{in}\,?x \longrightarrow \big(\mathit{InputMoney} \big)$$

The parser also admits some special commands that are tokenised as hard spaces, such as `\circblockbegin`, `\circblockend`, *etc.*

$$\begin{array}{ll}
\mathit{Output} \mathrel{\widehat=} & (\mathit{money} \geq \mathit{cookieValue}) \mathbin{\&} \\
& (\mathbf{var}\ \ o : \mathit{COOKIE} \bullet \big(\mathit{OutputCookie} \big) \ ;\ (\mathit{out}\,!o \longrightarrow \mathit{change}\,!\mathit{money} \longrightarrow \mathbf{Skip}))
\end{array}$$

$$\bullet\ \mathbf{var}\ o! : \mathit{COOKIE} \bullet \mathit{OutputCookie}$$

end

Z Declarations	**Total**
Unboxed items	4
Axiomatic definitions	1
Generic axiomatic defs.	0
Schemas	3
Generic schemas	0
Theorems	0
Proofs	0
Total	**8**
Circus **Declarations**	**Total**
Channel decls.	2
Channel set decls.	0
Process decls.	1
Process ref. assertions	0
Name sets	0
Actions	5
Action ref. assertions	0
Total	**16**

Table 1: Summary of all *Circus* declarations.