1 Simple Vending Machine

This is a simple example of using the small step sematics with lhs2TeX.

Described here is a vending machine environment, state, signals, and errors. The environment contains the cost (in tokens) of a soda, and whether or not the machine is powered on. The state of the vending machine holds the number of unspent tokens and the number of remaining sodas. There are two signals, pushing the vending button or depositing some number of tokens.

$$
\begin{aligned}
&\mathit{Env} = (\ \{\ \mathit{\_power} :: \mathit{Bool}, \mathit{\_cost} :: \mathit{Int}\ \}\ ) \\
&\mathit{St} = (\ \{\ \mathit{\_tokens} :: \mathit{Int}, \mathit{\_sodas} :: \mathit{Int}\ \}\ ) \\
&\mathit{Sig} = \mathit{Push} \mid \mathit{Deposit\ Int} \\
&\mathit{Error} = \mathit{SmallDeposit} \mid \mathit{OutOfSoda} \mid \mathit{OutOfOrder}
\end{aligned}
$$

$$\text{vending-rule-deposit}\ \frac{env.power}{\begin{pmatrix} power \\ cost \end{pmatrix} \vdash \begin{pmatrix} tokens \\ sodas \end{pmatrix} \xrightarrow[\text{VEND}]{Deposit\ t} \begin{pmatrix} st.tokens + t \\ st.sodas \end{pmatrix}} \quad (1)$$

$$\text{vending-rule-push}\ \frac{\begin{array}{l} env.power \\ st\ .tokens \geqslant env.cost \\ st\ .sodas \not\equiv 0 \\ \\ tokens' = st.tokens - env.cost \\ sodas' = st.sodas - 1 \end{array}}{\begin{pmatrix} power \\ cost \end{pmatrix} \vdash \begin{pmatrix} tokens \\ sodas \end{pmatrix} \xrightarrow[\text{VEND}]{Push} \begin{pmatrix} tokens' \\ sodas' \end{pmatrix}} \quad (2)$$

Figure 1: vending inference rules

2 Tests

$testDeposit :: Assertion$

$testDeposit = vend\ (\begin{pmatrix} True \\ 1 \end{pmatrix})\ (\begin{pmatrix} 0 \\ 1 \end{pmatrix})\ (Deposit\ 2) \stackrel{?}{=} \text{Valid Transition: } (\begin{pmatrix} 2 \\ 1 \end{pmatrix})$

$testGetSoda :: Assertion$

$testGetSoda = vend\ (\begin{pmatrix} True \\ 1 \end{pmatrix})\ (\begin{pmatrix} 1 \\ 1 \end{pmatrix})\ Push \stackrel{?}{=} \text{Valid Transition: } (\begin{pmatrix} 0 \\ 0 \end{pmatrix})$

$testSmallDep :: Assertion$

$testSmallDep = vend\ (\begin{pmatrix} True \\ 1 \end{pmatrix})\ (\begin{pmatrix} 0 \\ 1 \end{pmatrix})\ Push \stackrel{?}{=} \text{Error: } [SmallDeposit]$

$testOutOfSoda :: Assertion$

$testOutOfSoda = vend\ (\begin{pmatrix} True \\ 1 \end{pmatrix})\ (\begin{pmatrix} 1 \\ 0 \end{pmatrix})\ Push \stackrel{?}{=} \text{Error: } [OutOfSoda]$

$testSmallNoSoda :: Assertion$

$testSmallNoSoda = vend\ (\begin{pmatrix} True \\ 1 \end{pmatrix})\ (\begin{pmatrix} 0 \\ 0 \end{pmatrix})\ Push \stackrel{?}{=} \text{Error: } [SmallDeposit, OutOfSoda]$