INTERPRETATION USING DENOTATIONAL SEMANTICS

$M[\![\texttt{input x; x := x + 1; output x}]\!]\ <4, 1, 7>$

$(S[\![\texttt{input x; x := x + 1; output x}]\!] < \lambda V.\bot, <4, 1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{x := x + 1; output x}]\!]\ (S[\![\texttt{input x}]\!] < \lambda V.\bot, <4, 1, 7>, \mathit{nil}>)) \downarrow 3$

$(S[\![\texttt{x := x + 1; output x}]\!]$
$\quad (\text{if } <4, 1, 7> = \mathit{nil} \text{ then } \top \text{ else } < \lambda V.\bot[\mathit{hd}(<4, 1, 7>)/x], <1, 7>, \mathit{nil}>)) \downarrow 3$

$(S[\![\texttt{x := x + 1; output x}]\!] < \lambda V.\bot[\mathit{hd}(<4, 1, 7>)/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{x := x + 1; output x}]\!] < \lambda V.\bot[4/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (S[\![\texttt{x := x + 1}]\!] < \lambda V.\bot[4/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][E[\![\texttt{x + 1}]\!]\ (\lambda V.\bot[4/x])/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][(E[\![\texttt{x}]\!]\ (\lambda V.\bot[4/x]) + E[\![\texttt{1}]\!]\ (\lambda V.\bot[4/x]))/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]$
$\quad (< \lambda V.\bot[4/x][(\text{if } (\lambda V.\bot[4/x])[\![\texttt{x}]\!] = \bot \text{ then } \top$
$\qquad \text{else } (\lambda V.\bot[4/x])[\![\texttt{x}]\!] + E[\![\texttt{1}]\!]\ (\lambda V.\bot[4/x])/x],$
$\quad <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][(\text{if } 4 = \bot \text{ then } \top \text{ else } 4) + E[\![\texttt{1}]\!]\ (\lambda V.\bot[4/x])/x], <1, 7>, \mathit{nil}>) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][(4 + E[\![\texttt{1}]\!]\ (\lambda V.\bot[4/x]))/x], <1, 7>, \mathit{nil}>)) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][(4 + 1)/x], <1, 7>, \mathit{nil}>)) \downarrow 3$

$(S[\![\texttt{output x}]\!]\ (< \lambda V.\bot[4/x][5/x], <1, 7>, \mathit{nil}>)) \downarrow 3$

$(\text{if } (\lambda V.\bot[4/x][5/x])\ [\![\texttt{x}]\!] = \bot \text{ then } \top$
$\quad \text{else } < \lambda V.\bot[4/x][5/x], <1, 7>, \mathit{append}\ \mathit{nil}\ (\mathit{list}\ ((\lambda V.\bot[4/x][5/x])\ [\![\texttt{x}]\!]\ )) >) \downarrow 3$

$(\text{if } (\lambda V.\bot[4/x][5/x])\ [\![\texttt{x}]\!] = \bot \text{ then } \top$
$\quad \text{else } < \lambda V.\bot[4/x][5/x], <1, 7>, \mathit{append}\ \mathit{nil}\ (\mathit{list}\ (\lambda V.\bot[4/x][5/x][\![\texttt{x}]\!]\ ))>) \downarrow 3$

$(\text{if } 5 = \bot \text{ then } \top \text{ else } < \lambda V.\bot[4/x][5/x], <1, 7>, \mathit{append}\ \mathit{nil}\ (\mathit{list}\ 5)>) \downarrow 3$

$(< \lambda V.\bot[4/x][5/x], <1, 7>, <5>>) \downarrow 3$

$<5>$