Un jugement d'évaluation s'écrit sous la forme $\gamma \vdash [e\,,\,m_1] \Downarrow [v\,,\,m_2]$.

Règles

$$\gamma \vdash [\mathit{entier}\,,\,m] \Downarrow [\mathit{entier}\,,\,m] \qquad \gamma \vdash [\mathit{booleen}\,,\,m] \Downarrow [\mathit{booleen}\,,\,m]$$

$$\frac{x \in \gamma \quad \gamma(x) = \langle\, e\,,\,\gamma_{def}\,\rangle \quad \gamma_{def} \vdash [e\,,\,m_1] \Downarrow [v\,,\,m_2]}{\gamma \vdash [x\,,\,m_1] \Downarrow [v\,,\,m_2]} \qquad \frac{x \in \gamma \quad \gamma(x) = v \quad v \neq \langle\, e\,,\,\gamma_{def}\,\rangle}{\gamma \vdash [x\,,\,m] \Downarrow [v\,,\,m]}$$

$$\frac{\gamma \vdash [e_2\,,\,m_1] \Downarrow [v_2\,,\,m_2] \quad \gamma \vdash [e_1\,,\,m_2] \Downarrow [v_1\,,\,m_3] \quad v_1 \times v_2 \in \mathit{dom}\,\mathit{op} \quad v = v_1\,\mathit{op}\,v_2}{\gamma \vdash [e_1\ \mathit{op}\ e_2\,,\,m_1] \Downarrow [v\,,\,m_3]}$$

$$\frac{\gamma \vdash [e\,,\,m] \Downarrow [v\,,\,m'] \quad v \in \mathit{dom}\,\mathit{op} \quad v' = \mathit{op}\,v}{\gamma \vdash [\mathit{op}\,e\,,\,m] \Downarrow [v'\,,\,m']}$$

$$\frac{\gamma \vdash [e_1\,,\,m_1] \Downarrow [\texttt{true}\,,\,m_2] \quad \gamma \vdash [e_2\,,\,m_2] \Downarrow [v\,,\,m_3]}{\gamma \vdash [\texttt{if}\ e_1\ \texttt{then}\ e_2\ \texttt{else}\ e_3\,,\,m_1] \Downarrow [v\,,\,m_3]} \qquad \frac{\gamma \vdash [e_1\,,\,m_1] \Downarrow [\texttt{false}\,,\,m_2] \quad \gamma \vdash [e_3\,,\,m_2] \Downarrow [v\,,\,m_3]}{\gamma \vdash [\texttt{if}\ e_1\ \texttt{then}\ e_2\ \texttt{else}\ e_3\,,\,m_1] \Downarrow [v\,,\,m_3]}$$

$$\frac{\gamma \vdash [e_1\,,\,m_1] \Downarrow [v_1\,,\,m_2] \quad \gamma :: \{x \mapsto v_1\} \vdash [e_2\,,\,m_2] \Downarrow [v\,,\,m_3]}{\gamma \vdash [\texttt{let}\ x\ \texttt{=}\ e_1\ \texttt{in}\ e_2\,,\,m_1] \Downarrow [v\,,\,m_3]}$$

$$\gamma \vdash [\texttt{fun}\ x\ \texttt{->}\ e\,,\,m] \Downarrow [\langle\, \texttt{fun}\ x\ \texttt{->}\ e\,,\,\gamma\,\rangle\,,\,m]$$

$$\frac{\gamma \vdash [e_2\,,\,m_1] \Downarrow [v_2\,,\,m_2] \quad \gamma \vdash [e_1\,,\,m_2] \Downarrow [\langle\, \texttt{fun}\ x\ \texttt{->}\ e_3\,,\,\gamma_{def}\,\rangle\,,\,m_3] \quad \gamma_{def} :: \{x \mapsto v_2\} \vdash [e_3\,,\,m_3] \Downarrow [v\,,\,m_4]}{\gamma \vdash [(e_1\ )\ e_2\,,\,m_1] \Downarrow [v\,,\,m_4]}$$

$$\frac{\gamma :: \{x \mapsto \langle\, \texttt{letrec}\ x\ \texttt{=}\ e_1\ \texttt{in}\ e_1\,,\,\gamma\,\rangle\} \vdash [e_2\,,\,m_1] \Downarrow [v\,,\,m_2]}{\gamma \vdash [\texttt{letrec}\ x\ \texttt{=}\ e_1\ \texttt{in}\ e_2\,,\,m_1] \Downarrow [v\,,\,m_2]}$$

Justifications

Opération binaire

```
# let x = ref 1 in ((x:=2;(!x))+(!x));;
- : int = 3
# let x = ref 1 in ((!x)+(x:=2;(!x)));;
- : int = 4
```

Appel de fonction

```
# let x = ref 1 in (x:=2; fun y -> y+(!x)) (!x) ;;
- : int = 3
# let x = ref 1 in (fun y -> y +(!x)) (x:=2; (!x));;
- : int = 4
```