EvalML5

Syntax:

$$
\begin{aligned}
&\boldsymbol{i} \in \mathbf{int}\\
&\boldsymbol{b} \in \mathbf{bool}\\
&\boldsymbol{x}, \boldsymbol{y} \in \mathbf{Var}\\
&\boldsymbol{v} \in \mathbf{Value} ::= \boldsymbol{i} \mid \boldsymbol{b} \mid \texttt{(}\boldsymbol{\mathcal{E}}\texttt{)[fun } \boldsymbol{x} \texttt{ -> } \boldsymbol{e}\texttt{]} \mid \texttt{(}\boldsymbol{\mathcal{E}}\texttt{)[rec } \boldsymbol{x} \texttt{ = fun } \boldsymbol{y} \texttt{ -> } \boldsymbol{e}\texttt{]} \mid \texttt{[]} \mid \boldsymbol{v} \texttt{ :: } \boldsymbol{v}\\
&\boldsymbol{\mathcal{E}} \in \mathbf{Env} ::= \bullet \mid \boldsymbol{\mathcal{E}}, \boldsymbol{x} \texttt{ = } \boldsymbol{v}\\
&\boldsymbol{p} \in \mathbf{Pat} ::= \boldsymbol{x} \mid \texttt{[]} \mid \boldsymbol{p} \texttt{ :: } \boldsymbol{p} \mid \texttt{\_}\\
&\boldsymbol{res} \in \mathbf{Res} ::= \boldsymbol{\mathcal{E}} \mid F\\
&\boldsymbol{c} \in \mathbf{Clauses} ::= \boldsymbol{p} \texttt{ -> } \boldsymbol{e} \mid \boldsymbol{p} \texttt{ -> } \boldsymbol{e} \texttt{ | } \boldsymbol{c}\\
&\boldsymbol{e} \in \mathbf{Exp} ::= \boldsymbol{i} \mid \boldsymbol{b} \mid \boldsymbol{x} \mid \boldsymbol{e}\ \boldsymbol{op}\ \boldsymbol{e} \mid \texttt{if } \boldsymbol{e} \texttt{ then } \boldsymbol{e} \texttt{ else } \boldsymbol{e} \mid \texttt{let } \boldsymbol{x} \texttt{ = } \boldsymbol{e} \texttt{ in } \boldsymbol{e}\\
&\qquad\qquad \mid \texttt{fun } \boldsymbol{x} \texttt{ -> } \boldsymbol{e} \mid \boldsymbol{e}\ \boldsymbol{e} \mid \texttt{let rec } \boldsymbol{x} \texttt{ = fun } \boldsymbol{y} \texttt{ -> } \boldsymbol{e} \texttt{ in } \boldsymbol{e}\\
&\qquad\qquad \mid \texttt{[]} \mid \boldsymbol{e} \texttt{ :: } \boldsymbol{e} \mid \texttt{match } \boldsymbol{e} \texttt{ with } \boldsymbol{c}\\
&\boldsymbol{op} \in \mathbf{Prim} ::= \texttt{+} \mid \texttt{-} \mid \texttt{*} \mid \texttt{<}
\end{aligned}
$$

空の環境 $\bullet$ (とそれに続くコンマ) は入力時には省略する.

Derivation Rules:

$$\frac{}{\boldsymbol{x} \texttt{ matches } \boldsymbol{v} \texttt{ when } (\boldsymbol{x} \texttt{ = } \boldsymbol{v})} \quad \text{(M-Var)}$$

$$\frac{}{\texttt{[] matches [] when ()}} \quad \text{(M-Nil)}$$

$$\frac{\boldsymbol{p_1} \texttt{ matches } \boldsymbol{v_1} \texttt{ when } (\boldsymbol{\mathcal{E}_1}) \qquad \boldsymbol{p_2} \texttt{ matches } \boldsymbol{v_2} \texttt{ when } (\boldsymbol{\mathcal{E}_2}) \qquad (\boldsymbol{\mathcal{E}} = \boldsymbol{\mathcal{E}_1} \uplus \boldsymbol{\mathcal{E}_2})}{\boldsymbol{p_1} \texttt{ :: } \boldsymbol{p_2} \texttt{ matches } \boldsymbol{v_1} \texttt{ :: } \boldsymbol{v_2} \texttt{ when } (\boldsymbol{\mathcal{E}})} \quad \text{(M-Cons)}$$

$$\frac{}{\texttt{\_ matches } \boldsymbol{v} \texttt{ when ()}} \quad \text{(M-Wild)}$$

$$\frac{}{\texttt{[] doesn't match } \boldsymbol{v_1} \texttt{ :: } \boldsymbol{v_2}} \quad \text{(NM-ConsNil)}$$

$$\frac{}{\boldsymbol{p_1} \texttt{ :: } \boldsymbol{p_2} \texttt{ doesn't match []}} \quad \text{(NM-NilCons)}$$

$$\frac{\boldsymbol{p_1} \texttt{ doesn't match } \boldsymbol{v_1}}{\boldsymbol{p_1} \texttt{ :: } \boldsymbol{p_2} \texttt{ doesn't match } \boldsymbol{v_1} \texttt{ :: } \boldsymbol{v_2}} \quad \text{(NM-ConsConsL)}$$

$$\frac{\boldsymbol{p_2} \texttt{ doesn't match } \boldsymbol{v_2}}{\boldsymbol{p_1} \texttt{ :: } \boldsymbol{p_2} \texttt{ doesn't match } \boldsymbol{v_1} \texttt{ :: } \boldsymbol{v_2}} \quad \text{(NM-ConsConsR)}$$

$$\frac{}{\mathcal{E} \vdash i \Downarrow i} \quad \text{(E-Int)}$$

$$\frac{}{\mathcal{E} \vdash b \Downarrow b} \quad \text{(E-Bool)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow \texttt{true} \qquad \mathcal{E} \vdash e_2 \Downarrow v}{\mathcal{E} \vdash \texttt{if } e_1 \texttt{ then } e_2 \texttt{ else } e_3 \Downarrow v} \quad \text{(E-IfT)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow \texttt{false} \qquad \mathcal{E} \vdash e_3 \Downarrow v}{\mathcal{E} \vdash \texttt{if } e_1 \texttt{ then } e_2 \texttt{ else } e_3 \Downarrow v} \quad \text{(E-IfF)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow i_1 \qquad \mathcal{E} \vdash e_2 \Downarrow i_2 \qquad i_1 \texttt{ plus } i_2 \texttt{ is } i_3}{\mathcal{E} \vdash e_1 \texttt{ + } e_2 \Downarrow i_3} \quad \text{(E-Plus)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow i_1 \qquad \mathcal{E} \vdash e_2 \Downarrow i_2 \qquad i_1 \texttt{ minus } i_2 \texttt{ is } i_3}{\mathcal{E} \vdash e_1 \texttt{ - } e_2 \Downarrow i_3} \quad \text{(E-Minus)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow i_1 \qquad \mathcal{E} \vdash e_2 \Downarrow i_2 \qquad i_1 \texttt{ times } i_2 \texttt{ is } i_3}{\mathcal{E} \vdash e_1 \texttt{ * } e_2 \Downarrow i_3} \quad \text{(E-Times)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow i_1 \qquad \mathcal{E} \vdash e_2 \Downarrow i_2 \qquad i_1 \texttt{ less than } i_2 \texttt{ is } b_3}{\mathcal{E} \vdash e_1 \texttt{ < } e_2 \Downarrow b_3} \quad \text{(E-Lt)}$$

$$\frac{(\mathcal{E}(x) = v)}{\mathcal{E} \vdash x \Downarrow v} \quad \text{(E-Var)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow v_1 \qquad \mathcal{E}, x \texttt{ = } v_1 \vdash e_2 \Downarrow v}{\mathcal{E} \vdash \texttt{let } x \texttt{ = } e_1 \texttt{ in } e_2 \Downarrow v} \quad \text{(E-Let)}$$

$$\frac{}{\mathcal{E} \vdash \texttt{fun } x \to e \Downarrow (\mathcal{E})[\texttt{fun } x \to e]} \quad \text{(E-Fun)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow (\mathcal{E}_2)[\texttt{fun } x \to e_0] \qquad \mathcal{E} \vdash e_2 \Downarrow v_2 \qquad \mathcal{E}_2, x \texttt{ = } v_2 \vdash e_0 \Downarrow v}{\mathcal{E} \vdash e_1\ e_2 \Downarrow v} \quad \text{(E-App)}$$

$$\frac{\mathcal{E}, x \texttt{ = } (\mathcal{E})[\texttt{rec } x \texttt{ = fun } y \to e_1] \vdash e_2 \Downarrow v}{\mathcal{E} \vdash \texttt{let rec } x \texttt{ = fun } y \to e_1 \texttt{ in } e_2 \Downarrow v} \quad \text{(E-LetRec)}$$

$$\frac{\begin{array}{c}\mathcal{E} \vdash e_1 \Downarrow (\mathcal{E}_2)[\texttt{rec } x \texttt{ = fun } y \to e_0] \qquad \mathcal{E} \vdash e_2 \Downarrow v_2 \\ \mathcal{E}_2, x \texttt{ = } (\mathcal{E}_2)[\texttt{rec } x \texttt{ = fun } y \to e_0], y \texttt{ = } v_2 \vdash e_0 \Downarrow v\end{array}}{\mathcal{E} \vdash e_1\ e_2 \Downarrow v} \quad \text{(E-AppRec)}$$

$$\frac{}{\mathcal{E} \vdash [] \Downarrow []} \quad \text{(E-Nil)}$$

$$\frac{\mathcal{E} \vdash e_1 \Downarrow v_1 \qquad \mathcal{E} \vdash e_2 \Downarrow v_2}{\mathcal{E} \vdash e_1 :: e_2 \Downarrow v_1 :: v_2} \quad \text{(E-Cons)}$$

$$\frac{\mathcal{E} \vdash e_0 \Downarrow v \qquad p \text{ matches } v \text{ when } (\mathcal{E}_1) \qquad (\mathcal{E}_2 = \mathcal{E}; \mathcal{E}_1) \qquad \mathcal{E}_2 \vdash e \Downarrow v'}{\mathcal{E} \vdash \texttt{match } e_0 \texttt{ with } p \to e \Downarrow v'} \quad \text{(E-MatchM1)}$$

$$\frac{\mathcal{E} \vdash e_0 \Downarrow v \qquad p \text{ matches } v \text{ when } (\mathcal{E}_1) \qquad (\mathcal{E}_2 = \mathcal{E}; \mathcal{E}_1) \qquad \mathcal{E}_2 \vdash e \Downarrow v'}{\mathcal{E} \vdash \texttt{match } e_0 \texttt{ with } p \to e \texttt{ | } c \Downarrow v'} \quad \text{(E-MatchM2)}$$

$$\frac{\mathcal{E} \vdash e_0 \Downarrow v \qquad p \text{ doesn't match } v \qquad \mathcal{E} \vdash \texttt{match } e_0 \texttt{ with } c \Downarrow v'}{\mathcal{E} \vdash \texttt{match } e_0 \texttt{ with } p \to e \texttt{ | } c \Downarrow v'} \quad \text{(E-MatchN)}$$

$$\frac{(i_3 = i_1 + i_2)}{i_1 \texttt{ plus } i_2 \texttt{ is } i_3} \quad \text{(B-Plus)}$$

$$\frac{(i_3 = i_1 - i_2)}{i_1 \texttt{ minus } i_2 \texttt{ is } i_3} \quad \text{(B-Minus)}$$

$$\frac{(i_3 = i_1 * i_2)}{i_1 \texttt{ times } i_2 \texttt{ is } i_3} \quad \text{(B-Times)}$$

$$\frac{(b_3 = (i_1 < i_2))}{i_1 \texttt{ less than } i_2 \texttt{ is } b_3} \quad \text{(B-Lt)}$$