Amal's SoupPCF

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1 Syntax

$$
\begin{array}{lll}
t & ::= & \mathit{unit} \mid \mathit{int} \mid t \to t \mid \mathit{LS} \\
e & ::= & () \mid n \mid \mathit{if0}\ e_1\ e_2\ e_3 \mid e_1\ p\ e_2 \mid x \mid \mathit{lam}\ x : t.e \mid e_1\ e_2 \mid \mathit{nil} \mid \mathit{consl}\ e_1\ e_2 \mid \mathit{conss}\ e \\
 & & \mid \mathit{case}\ e\ \mathit{of}\ \mathit{nil} \Rightarrow e_1; \mathit{consl}\ x\ rx \Rightarrow e_2; \mathit{conss}\ x \Rightarrow e_3 \\
p & ::= & + \mid - \\
\Gamma & ::= & . \mid \Gamma, x : t
\end{array}
$$

2 Typing Judgement

$$\frac{}{\Gamma \vdash () : \mathit{unit}}\ \text{T-UNIT} \qquad \frac{}{\Gamma \vdash n : \mathit{int}}\ \text{T-INT} \qquad \frac{x : T \in \Gamma}{\Gamma \vdash x : T}\ \text{T-VAR}$$

$$\frac{\Gamma \vdash e_1 : \mathit{int} \quad \Gamma \vdash e_2 : T \quad \Gamma \vdash e_3 : T}{\Gamma \vdash \mathit{if0}\ e_1\ e_2\ e_3 : T}\ \text{T-IF0}$$

$$\frac{\Gamma \vdash e_1 : T_1 \to T_2 \quad \Gamma \vdash e_2 : T_1}{\Gamma \vdash e_1\ e_2 : T_2}\ \text{T-APP}$$

$$\frac{\Gamma, x : T_1 \vdash e_2 : T_2}{\Gamma \vdash \mathit{lam}\ x : T_1.e : T_2}\ \text{T-ABS}$$

$$\frac{\Gamma \vdash e_1 : \mathit{int} \quad \Gamma \vdash e_2 : \mathit{int}}{\Gamma \vdash e_1\ p\ e_2 : \mathit{int}}\ \text{T-P}$$

$$\frac{}{\Gamma \vdash \mathit{nil} : \mathit{LS}}\ \text{T-NIL}$$

$$\frac{\Gamma \vdash e_1 : \text{int} \quad \Gamma \vdash e_2 : \mathit{LS}}{\Gamma \vdash \mathit{consl}\ e_1\ e_2 : \mathit{LS}}\ \text{T-CONSL} \qquad \frac{\Gamma \vdash e : \mathit{unit} \to \mathit{LS}}{\Gamma \vdash \mathit{conss}\ e : \text{LS}}\ \text{T-CONSS}$$

$$\frac{\Gamma \vdash e : \text{ LS} \quad \Gamma \vdash e_1 : t \quad \Gamma, x : \text{ int},\ rx : \text{ LS} \vdash e_2 : t \quad \Gamma, x : \text{ unit} \to \text{LS} \vdash e_3 : t}{\Gamma \vdash \text{ case } e \text{ of nil} \Rightarrow e_1;\ \text{cons-l } x\ rx \Rightarrow e_2;\ \text{cons-s } x \Rightarrow e_3 : t}\ \text{T-CASE}$$

3 CBV Operational Semantics

$$
\begin{array}{lll}
v & ::= & () \mid n \mid lam\ x : t.e \mid nil \mid consl\ v_1\ v_2 \mid conss\ v \\
E & ::= & [.] \mid if0\ E\ e_2\ e_3 \mid E\ p\ e_2 \mid v_1\ p\ E \mid E\ e_2 \mid v_1\ E \mid consl\ E\ e_2 \mid consl\ v\ E \mid conss\ E \mid \\
 & & \mid case\ E\ of\ nil \Rightarrow e_1; consl\ x\ rx \Rightarrow e_2; conss\ x \Rightarrow e_3
\end{array}
$$