CPSC 629: Deductive Systems

Assignment 2

Due: 10/5/2000, 4pm

1. Given is the following subset of reduction rules for the operational semantics of Mini-ML. Represent these rules in LF, following the same scheme presented in class.

$$\frac{}{\langle\rangle \hookrightarrow \langle\rangle}\ \textsf{ev\_unit}$$

$$\frac{e_1 \hookrightarrow v_1 \qquad e_2 \hookrightarrow v_2}{\langle e_1, e_2\rangle \hookrightarrow \langle v_1, v_2\rangle}\ \textsf{ev\_pair} \qquad \frac{e \hookrightarrow \langle v_1, v_2\rangle}{\mathbf{fst}\ e \hookrightarrow v_1}\ \textsf{ev\_fst} \qquad \frac{e \hookrightarrow \langle v_1, v_2\rangle}{\mathbf{snd}\ e \hookrightarrow v_2}\ \textsf{ev\_snd}$$

$$\frac{e \hookrightarrow v}{\mathbf{inl}\ e \hookrightarrow \mathbf{inl}\ v}\ \textsf{ev\_inl} \qquad \frac{e \hookrightarrow v}{\mathbf{inr}\ e \hookrightarrow \mathbf{inr}\ v}\ \textsf{ev\_inl}$$

$$\frac{e_1 \hookrightarrow \mathbf{inl}\ v_1 \qquad [v_1/x_2]e_2 \hookrightarrow v}{(\mathbf{case}\ e_1\ \mathbf{of}\ \mathbf{inl}\ x_2 \Rightarrow e_2 |\ \mathbf{inr}\ x_3 \Rightarrow e_3) \hookrightarrow v}\ \textsf{ev\_case\_inl}$$

$$\frac{e_1 \hookrightarrow \mathbf{inr}\ v_1 \qquad [v_1/x_3]e_3 \hookrightarrow v}{(\mathbf{case}\ e_1\ \mathbf{of}\ \mathbf{inl}\ x_2 \Rightarrow e_2 |\ \mathbf{inr}\ x_3 \Rightarrow e_3) \hookrightarrow v}\ \textsf{ev\_case\_inr}$$

$$\frac{e_1 \hookrightarrow v_1 \qquad [v_1/x]e_2 \hookrightarrow v}{\mathbf{let}\ x = e_1\ \mathbf{in}\ e_2 \hookrightarrow v}\ \textsf{ev\_let} \qquad \frac{[\mathbf{fix}\ x.\, e/x]e \hookrightarrow v}{\mathbf{fix}\ x.\, e \hookrightarrow v}\ \textsf{ev\_fix}$$

2. Give an LF object that represents the evaluation of ($double$ ($\mathbf{s}\ \mathbf{z}$)) where the function $double$ is defined as usual.

$$double = \mathbf{fix}\ f.\, \mathbf{lam}\ x.\, \mathbf{case}\ x\ \mathbf{of}\ \mathbf{z}\ \Rightarrow \mathbf{z} \mid \mathbf{s}\ x' \Rightarrow \mathbf{s}\ (\mathbf{s}\ (\mathbf{app}\ f\ x'))$$