Assignment #2

Diego Oniarti - 257835

1 Missing Progress Cases

Write the proof for the progress theorem for the following cases

- $t \equiv \ inl\ t_1$
- $t \equiv \text{case } t_0 \text{ of } \left| \begin{array}{l} inl\ x_1 \mapsto t_1 \\ inr\ x_2 \mapsto t_2 \end{array} \right.$

Theorem:

$$\text{if } \emptyset \vdash t : \tau \text{ then either } \vdash t.VAL \text{ or } \exists t'.t \rightsquigarrow t'$$

Prof by induction on the typing derivation of t.
Base cases *t-var* and *t-nat* seen in class

1.1 $t \equiv \ inl\ t_1$

$$\text{if } \emptyset \vdash \ inl\ t : \tau_1 \uplus \tau_2 \text{ then either } \vdash \ inl\ t.\text{VAL or } \exists t'.\ inl\ t \rightsquigarrow t'$$

$$\begin{array}{rll} & \dfrac{\emptyset \vdash t : \tau_1}{\emptyset \vdash \ inl\ t : \tau_1 \uplus \tau_2}\text{T-inl} & \\ \text{t.s. either} & \vdash \ inl\ t.\text{VAL} & \\ \text{or} & \exists t'.\ inl\ t \rightsquigarrow t' & \\ \text{by I.H. either} & \vdash t.\text{VAL} & \text{I1} \\ \text{or} & \exists t".t \rightsquigarrow t" & \text{I2} \end{array}$$

Assuming I1 $\quad inl\ t.\text{VAL}$ by I1 and definition of inl . $\square$

Assuming I2

$$\begin{array}{rll} \text{by inversion on I2 w.h.} & t \equiv E[t_0] & \text{HE1} \\ & t" \equiv E[t_0"] & \text{HE1'} \\ & t_0 \rightsquigarrow^p t_0" & \text{HPR} \\ \text{by HE1, HE1' t.s.} & inl\ E[t_0] \rightsquigarrow \ inl\ E[t_0"] & \\ \text{by ctx with HPR and} & E' = \ inl\ E_\square & \end{array}$$

1.2 $t \equiv$ **case** t_0 **of** $\left| \begin{array}{l} inl\ x_1 \mapsto t_1 \\ inr\ x_2 \mapsto t_2 \end{array} \right.$

2 Missing Compatibility Lemmas

Write the proof for these compatibility lemmas: