Models of Computation Assessed Coursework I

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This document is a skeleton which provides macros to help typeset your solution to the coursework.

Rules can be typeset like this:

$$\textsc{e.var}\ \frac{x \in \mathrm{dom}(s)}{\langle x, s, h\rangle \Downarrow_e \langle s(x), s, h\rangle} \qquad \textsc{e.num}\ \frac{}{\langle n, s, h\rangle \Downarrow_e \langle n, s, h\rangle}$$

$$\textsc{e.add}\ \frac{\langle E_1, s, h\rangle \Downarrow_e \langle n_1, s', h'\rangle \qquad \langle E_2, s', h'\rangle \Downarrow_e \langle n_2, s'', h''\rangle \qquad n_3 = n_1 \underline{+} n_2}{\langle E_1 + E_2, s, h\rangle \Downarrow_e \langle n_3, s'', h''\rangle}$$

$$\textsc{e.new}\ \frac{a \notin \mathrm{dom}(h) \qquad (a+1) \notin \mathrm{dom}(h)}{\langle \texttt{newpair}, s, h\rangle \Downarrow_e \langle \ulcorner a \urcorner, s, h[a \mapsto 0][a+1 \mapsto 0]\rangle}$$

$$\textsc{e.fst}\ \frac{\langle E, s, h\rangle \Downarrow_e \langle \ulcorner a \urcorner, s', h'\rangle \qquad a \in \mathrm{dom}(h')}{\langle E.\texttt{fst}, s, h\rangle \Downarrow_e \langle h'(a), s', h'\rangle}$$

$$\textsc{e.snd}\ \frac{\langle E, s, h\rangle \Downarrow_e \langle \ulcorner a \urcorner, s', h'\rangle \qquad a+1 \in \mathrm{dom}(h')}{\langle E.\texttt{snd}, s, h\rangle \Downarrow_e \langle h'(a+1), s', h'\rangle}$$

Derivations can be typeset as in Figure 1

Types:

$$\Gamma; s; h \vdash \mathsf{well\text{-}typed}$$
$$\Gamma \vdash E : \tau$$
$$h \Vdash v : \tau$$

Suppose that $\Gamma; s; h \vdash \mathsf{well\text{-}typed}$. We wish to show that

$$\Gamma \vdash E : \tau \implies h \Vdash v : \tau.$$

$$(\dagger) \equiv \vee\text{I-R}\,\dfrac{\neg\text{I}\,\dfrac{\neg\text{E}\,\dfrac{\vee\text{I-L}\,\dfrac{\neg(p \lor \neg p), p \vdash p}{\neg(p \lor \neg p), p \vdash p} \quad \text{Ax}\,\dfrac{}{\neg(p \lor \neg p) \vdash \neg(p \lor \neg p)}}{\neg(p \lor \neg p), p \vdash \bot}}{\neg(p \lor \neg p) \vdash \neg p}}{\neg(p \lor \neg p) \vdash p \lor \neg p}$$

$$\neg\neg\text{E}\,\dfrac{\neg\text{I}\,\dfrac{\neg\text{E}\,\dfrac{(\dagger) \quad \text{Ax}\,\dfrac{}{\neg(p \lor \neg p) \vdash \neg(p \lor \neg p)}}{\neg(p \lor \neg p) \vdash \bot}}{\vdash \neg\neg(p \lor \neg p)}}{\vdash p \lor \neg p}$$

Figure 1: A derivation