CS 558 Programming Languages

Nandadeep Davuluru

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1 Big Step Semantics

1.1 Assign

$$\frac{\langle e,\sigma\rangle \Downarrow \langle n,\sigma'\rangle}{\langle :=\mathbf{x}\ \mathbf{e},\sigma\rangle \Downarrow \sigma'[x \mapsto n]}$$

1.2 Leq

$$\frac{\langle e_1,\sigma\rangle \Downarrow \langle n,\sigma'\rangle \qquad \langle e_2,\sigma\rangle \Downarrow \langle n_2,\sigma"\rangle \qquad n{=}n_1 ! {\leq} n_2}{\langle <{=}n_1 n_2,\sigma\rangle \Downarrow \langle 0,\sigma'\rangle}$$

$$\frac{\langle e_1,\sigma\rangle \Downarrow \langle n,\sigma'\rangle \qquad \langle e_2,\sigma\rangle \Downarrow \langle n_2,\sigma"\rangle \qquad n{=}n_1 {\leq} n_2}{\langle <{=}n_1 n_2,\sigma\rangle \Downarrow \langle 1,\sigma'\rangle}$$

1.3 Add

$$\frac{\langle e_1,\sigma\rangle \Downarrow \langle n_1,\sigma'\rangle \qquad \langle e_2,\sigma\rangle \Downarrow \langle n_2,\sigma"\rangle \qquad n{=}n_1{+}n_2}{\langle +n_1 n_2,\sigma\rangle \Downarrow \langle n,\sigma\rangle}$$

1.4 While

$$\frac{\langle c,\sigma\rangle \Downarrow \langle s_1,\sigma'\rangle \qquad \langle b,\sigma\rangle \Downarrow \langle s_2,\sigma''\rangle \qquad c!{=}0}{\langle \mathbf{while\ c\ b},\sigma\rangle \Downarrow \langle 1,\sigma'\rangle}$$

$$\frac{\langle c,\sigma\rangle \Downarrow \langle s_1,\sigma'\rangle \qquad c{=}0}{\langle \mathbf{while\ c\ b},\sigma\rangle \Downarrow \langle 0,\sigma'\rangle}$$

1.5 Variable

$$\frac{n{=}\sigma(x)}{\langle x,\sigma\rangle \Downarrow \langle n,\sigma\rangle}$$

1.6 If

$$\frac{\langle c,\sigma\rangle \Downarrow \langle n,\sigma'\rangle \qquad \langle f,\sigma\rangle \Downarrow \langle n,\sigma''\rangle \qquad c!{=}0}{\langle \mathbf{if\ c\ t\ f},\sigma\rangle \Downarrow \langle 1,\sigma'\rangle}$$

$$\frac{\langle c,\sigma\rangle \Downarrow \langle n,\sigma'\rangle \qquad c{=}0}{\langle \mathbf{if\ c\ t\ f},\sigma\rangle \Downarrow \langle 0,\sigma'\rangle}$$

1.7 Seq

$$\frac{\langle s_1,\sigma\rangle \Downarrow \langle n_1,\sigma'\rangle \qquad \langle s_2,\sigma\rangle \Downarrow \langle n_2,\sigma'\rangle}{\langle seq s_1 s_2\rangle \Downarrow \langle s_2,\sigma'\rangle}$$

1.8 Skip

$$\frac{}{\langle \mathbf{skip}, \sigma \rangle \Downarrow \langle 0, \sigma \rangle}$$

2 Additional Task

The expression that yielded different results is as follows:

(seq (* 0 7) (:= a (+ 2 (* 2 (/ 9 (:= a (+ a 2)))))))

For TestInterp1 ($left \longrightarrow right$) the answer is 6 whereas for TestInterp1b ($right \longrightarrow left$) it is 10.