Structural Operational Semantics

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November 14, 2019

1 SOS

1.1 i32

$$\langle e, \sigma \rangle \Downarrow n \tag{1}$$

1.2 bool

$$\langle e, \sigma \rangle \Downarrow b \tag{2}$$

1.3 Unop

1.3.1 Not

$$\frac{\langle b, \sigma \rangle \Downarrow false}{\langle !b, \sigma \rangle \Downarrow true} \tag{3}$$

$$\frac{\langle b, \sigma \rangle \Downarrow true}{\langle !b, \sigma \rangle \Downarrow false} \tag{4}$$

1.3.2 Sub

$$\frac{\langle e, \sigma \rangle \Downarrow n}{\langle -e, \sigma \rangle \Downarrow -n} \tag{5}$$

1.4 Binop

1.4.1 Add

$$\frac{\langle e1, \sigma \rangle \Downarrow n1 \; \langle e2, \sigma \rangle \Downarrow n2}{\langle e1 + e2, \sigma \rangle \Downarrow n1 + n2} \tag{6}$$

1.4.2 Sub

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 - e2, \sigma\rangle \Downarrow n1 - n2} \tag{7}$$

1.4.3 Div

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1/e2, \sigma\rangle \Downarrow n1/n2} \tag{8}$$

1.4.4 Multiplication

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 * e2, \sigma\rangle \Downarrow n1 * n2} \tag{9}$$

1.4.5 Mod

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1\%e2, \sigma\rangle \Downarrow n1\%n2} \tag{10}$$

1.4.6 And

$$\frac{\langle b1, \sigma\rangle \Downarrow false \; \langle b2, \sigma\rangle \Downarrow false}{\langle e1\&\&e2, \sigma\rangle \Downarrow false} \tag{11}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow true \; \langle b2, \sigma\rangle \Downarrow false}{\langle e1\&\&e2, \sigma\rangle \Downarrow false} \tag{12}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow false \; \langle b2, \sigma\rangle \Downarrow true}{\langle e1\&\&e2, \sigma\rangle \Downarrow false} \tag{13}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow true \; \langle b2, \sigma\rangle \Downarrow true}{\langle e1\&\&e2, \sigma\rangle \Downarrow true} \tag{14}$$

1.4.7 Or

$$\frac{\langle b1, \sigma\rangle \Downarrow false \; \langle b2, \sigma\rangle \Downarrow false}{\langle e1 || e2, \sigma\rangle \Downarrow false} \tag{15}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow true \; \langle b2, \sigma\rangle \Downarrow false}{\langle e1 || e2, \sigma\rangle \Downarrow true} \tag{16}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow false \; \langle b2, \sigma\rangle \Downarrow true}{\langle e1 || e2, \sigma\rangle \Downarrow true} \tag{17}$$

$$\frac{\langle b1, \sigma\rangle \Downarrow true \; \langle b2, \sigma\rangle \Downarrow true}{\langle e1 || e2, \sigma\rangle \Downarrow true} \tag{18}$$

1.4.8 Not equal

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 != e2, \sigma\rangle \Downarrow true} \tag{19}$$

$$\frac{\langle e1, \sigma\rangle \Downarrow n \; \langle e2, \sigma\rangle \Downarrow n}{\langle e1 != e2, \sigma\rangle \Downarrow false} \tag{20}$$

1.4.9 Equal

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 == e2, \sigma\rangle \Downarrow false} \tag{21}$$

$$\frac{\langle e1, \sigma\rangle \Downarrow n \; \langle e2, \sigma\rangle \Downarrow n}{\langle e1 == e2, \sigma\rangle \Downarrow true} \tag{22}$$

1.4.10 Less or equal then

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 <= e2, \sigma\rangle \Downarrow n1 <= n2} \tag{23}$$

1.4.11 Larger or equal then

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 >= e2, \sigma\rangle \Downarrow n1 >= n2} \tag{24}$$

1.4.12 Less then

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 < e2, \sigma\rangle \Downarrow n1 < n2} \tag{25}$$

1.4.13 Larger then

$$\frac{\langle e1, \sigma\rangle \Downarrow n1 \; \langle e2, \sigma\rangle \Downarrow n2}{\langle e1 > e2, \sigma\rangle \Downarrow n1 > n2} \tag{26}$$

1.5 Assigment

$$\frac{}{\langle x := n, \sigma\rangle \Downarrow \sigma[x := n]} \tag{27}$$

1.6 Variable

$$\sigma[x := n] = n \tag{28}$$

1.7 If

$$\frac{\langle b, \sigma\rangle \Downarrow \mathit{true} \; \langle c1, \sigma\rangle \Downarrow \sigma'}{\langle \textbf{if } b \textbf{ then } c1 \textbf{ else } c2, \sigma\rangle \Downarrow \sigma'} \tag{29}$$

$$\frac{\langle b, \sigma\rangle \Downarrow \mathit{false} \; \langle c2, \sigma\rangle \Downarrow \sigma''}{\langle \textbf{if } b \textbf{ then } c1 \textbf{ else } c2, \sigma\rangle \Downarrow \sigma''} \tag{30}$$

1.8 While

$$\frac{\langle b, \sigma\rangle \Downarrow false}{\langle \textbf{while } b \textbf{ do } c, \sigma\rangle \Downarrow \sigma} \tag{31}$$

$$\frac{\langle b, \sigma\rangle \Downarrow true \, \langle c, \sigma\rangle \Downarrow \sigma' \langle \textbf{while } b \textbf{ do } c, \sigma'\rangle \Downarrow \sigma''}{\langle \textbf{while } b \textbf{ do } c, \sigma\rangle \Downarrow \sigma''} \tag{32}$$

1.9 Function call

$$\frac{\langle c, \sigma\rangle \Downarrow \sigma'}{\langle \textbf{call } c, \sigma\rangle \Downarrow \sigma'} \tag{33}$$

1.10 Return

$$\frac{\langle c, \sigma\rangle \Downarrow \sigma'}{\langle \textbf{return } c, \sigma\rangle \Downarrow \sigma'} \tag{34}$$