

Big-step Structural Operational Semantics (SOS)

Syntax

$a ::= n \mid x \mid a + a \mid a - a \mid a * a$

$b ::= \text{true} \mid \text{false} \mid a = a \mid a \leq a \mid \sim b \mid b \& b$

$c ::= \text{skip} \mid x := a \mid c_1 ; c_2 \mid \text{if } b \text{ then } c_1 \text{ else } c_2 \mid \text{while } b \text{ do } c$

aevalR

$$\frac{}{\sigma \vdash n \Downarrow n} \text{E-ANum} \qquad \frac{}{\sigma \vdash x \Downarrow \sigma(x)} \text{E-AId}$$

$$\frac{\sigma \vdash a_1 \Downarrow n_1 \quad \sigma \vdash a_2 \Downarrow n_2}{\sigma \vdash a_1 + a_2 \Downarrow n_1 + n_2} \text{E-Plus}$$

similar:
E-Minus, E-Mult

bevalR

$$\frac{}{\sigma \vdash \text{true} \Downarrow \text{true}} \text{E-BTrue} \qquad \frac{}{\sigma \vdash \text{false} \Downarrow \text{false}} \text{E-BFalse}$$

$$\frac{\sigma \vdash a_1 \Downarrow n_1 \quad \sigma \vdash a_2 \Downarrow n_2 \quad n_1 = n_2 \leftrightarrow \beta = \text{true}}{\sigma \vdash a_1 = a_2 \Downarrow \beta} \text{E-BEq}$$

similar - - - - E-BLe

$$\frac{\sigma \vdash b \Downarrow \beta}{\sigma \vdash \sim b \Downarrow \sim \beta}$$

$$\frac{\sigma \vdash b_1 \Downarrow \beta_1 \quad \sigma \vdash b_2 \Downarrow \beta_2}{\sigma \vdash b_1 \& b_2 \Downarrow \beta_1 \wedge \beta_2} \text{E-BAnd}$$

ceval

$$\frac{}{\sigma \vdash \text{skip} \rightarrow \sigma} \text{E-Skip} \qquad \frac{\sigma \vdash a \Downarrow n}{\sigma \vdash x := a \rightarrow \sigma[x \mapsto n]}$$

$$\frac{\sigma \vdash c_1 \rightarrow \sigma' \quad \sigma' \vdash c_2 \rightarrow \sigma''}{\sigma \vdash c_1 ; c_2 \rightarrow \sigma''}$$

$$\frac{\sigma \vdash b \Downarrow \text{true} \quad \sigma \vdash c_1 \rightarrow \sigma'}{\sigma \vdash \text{if } b \text{ then } c_1 \text{ else } c_2 \rightarrow \sigma'} \qquad \frac{\sigma \vdash b \Downarrow \text{false} \quad \sigma \vdash c_2 \rightarrow \sigma'}{\sigma \vdash \text{if } b \text{ then } c_1 \text{ else } c_2 \rightarrow \sigma'}$$

$$\frac{\sigma \vdash b \Downarrow \text{false}}{\sigma \vdash \text{while } b \text{ do } c \rightarrow \sigma}$$

$$\frac{\sigma \vdash b \Downarrow \text{true} \quad \sigma \vdash c \rightarrow \sigma' \quad \sigma' \vdash \text{while } b \text{ do } c \rightarrow \sigma''}{\sigma \vdash \text{while } b \text{ do } c \rightarrow \sigma''}$$