

1 Syntax

$$\begin{array}{ll}
 e ::= c \in \mathbb{Z} & s ::= \text{skip} \\
 \quad | x \in \text{Var} & \quad | s_1; s_2 \\
 \quad | e_1 + e_2 & \quad | x := e \\
 & \quad | \text{if } (e > 0) s_1 s_2 \\
 e_e ::= \cdot +_1 e & s_e ::= x :=_1 \cdot \\
 \quad | \cdot +_2 \cdot & \quad | \cdot ;_1 s_2 \\
 & \quad | \text{if}_1 s_1 s_2
 \end{array}$$

2 Semantics

2.1 Expressions

$$\begin{array}{c}
 \text{RED-CONST} \\
 \frac{}{E, c \Downarrow c} \\
 \\
 \text{RED-VAR} \\
 \frac{}{E, x \Downarrow E[x]} \quad x \in \text{dom}(E) \\
 \\
 \text{RED-VAR-UNDEF} \\
 \frac{}{E, x \Downarrow \text{err}} \quad x \notin \text{dom}(E) \\
 \\
 \text{RED-ADD} \\
 \frac{E, e_1 \Downarrow r \quad E, r, \cdot +_1 e_2 \Downarrow r'}{E, e_1 + e_2 \Downarrow r'} \\
 \\
 \text{RED-ADD-1} \\
 \frac{E, e_2 \Downarrow r \quad E, v_1, r, \cdot +_2 \cdot \Downarrow r'}{E, v_1, \cdot +_1 e_2 \Downarrow r'} \\
 \\
 \text{RED-ADD-2} \\
 \frac{}{E, v_1, v_2, \cdot +_2 \cdot \Downarrow v_1 + v_2}
 \end{array}$$

2.2 Statements

$$\begin{array}{c}
 \text{RED-SKIP} \\
 \frac{}{E, \text{skip} \Downarrow E} \\
 \\
 \text{RED-SEQ} \\
 \frac{E, s_1 \Downarrow r \quad r, \cdot ;_1 s_2 \Downarrow r'}{E, s_1; s_2 \Downarrow r'} \\
 \\
 \text{RED-SEQ-1} \\
 \frac{E, s_2 \Downarrow r}{E, \cdot ;_1 s_2 \Downarrow r} \\
 \\
 \text{RED-ASN} \\
 \frac{E, e \Downarrow r \quad E, r, x :=_1 \cdot \Downarrow r'}{E, x := e \Downarrow r'} \\
 \\
 \text{RED-ASN-1} \\
 \frac{}{E, v, x :=_1 \cdot \Downarrow E[x \leftarrow v]} \\
 \\
 \text{RED-IF} \\
 \frac{E, e \Downarrow r \quad E, r, \text{if}_1 s_1 s_2 \Downarrow r'}{E, \text{if } (e > 0) s_1 s_2 \Downarrow r'} \\
 \\
 \text{RED-IF-1-POS} \\
 \frac{E, s_1 \Downarrow r}{E, v, \text{if}_1 s_1 s_2 \Downarrow r} \quad v > 0 \\
 \\
 \text{RED-IF-1-NEG} \\
 \frac{E, s_2 \Downarrow r}{E, v, \text{if}_1 s_1 s_2 \Downarrow r} \quad v \leq 0
 \end{array}$$

2.3 Aborting Rules

$$\begin{array}{c}
 \text{RED-ERROR-EXPR} \\
 \frac{}{\sigma, e \Downarrow \text{err}} \quad \text{abort } \sigma \\
 \\
 \text{RED-ERROR-STAT} \\
 \frac{}{\sigma, s \Downarrow \text{err}} \quad \text{abort } \sigma
 \end{array}$$

$$\frac{\sigma = C[err]}{\mathbf{abort} \sigma}$$