6 Language Reference

The following rules define the syntax and large-step operational semantics of SIMPL. These should be the basis for your evaluator implementation.

6.1 Syntax of SIMPL

commands	$c ::= \texttt{skip} \mid c_1\texttt{;}c_2 \mid v\texttt{ := }a \mid \texttt{if }b\texttt{ then }c_1\texttt{ else }c_2 \mid \texttt{while }b\texttt{ do }c$
boolean expressions	$b ::= \texttt{true} \mid \texttt{false} \mid a_1\texttt{<=}a_2 \mid b_1\texttt{ \&\& }b_2 \mid b_1\texttt{ || }b_2 \mid \texttt{!}b$
arithmetic expressions	$a ::= n \mid v \mid a_1\texttt{ + }a_2 \mid a_1\texttt{ - }a_2 \mid a_1\texttt{ * }a_2$
variable names	v
integer constants	n

6.2 Operational Semantics of SIMPL

6.2.1 Commands

$$\langle \texttt{skip}, \sigma\rangle \Downarrow \sigma \tag{1}$$

$$\frac{\langle c_1, \sigma\rangle \Downarrow \sigma_2 \qquad \langle c_2, \sigma_2\rangle \Downarrow \sigma'}{\langle c_1\texttt{;}c_2, \sigma\rangle \Downarrow \sigma'} \tag{2}$$

$$\frac{\langle a, \sigma\rangle \Downarrow n}{\langle v\texttt{ := }a, \sigma\rangle \Downarrow \sigma[v \mapsto n]} \tag{3}$$

$$\frac{\langle b, \sigma\rangle \Downarrow T \qquad \langle c_1, \sigma\rangle \Downarrow \sigma'}{\langle \texttt{if }b\texttt{ then }c_1\texttt{ else }c_2, \sigma\rangle \Downarrow \sigma'} \tag{4}$$

$$\frac{\langle b, \sigma\rangle \Downarrow F \qquad \langle c_2, \sigma\rangle \Downarrow \sigma'}{\langle \texttt{if }b\texttt{ then }c_1\texttt{ else }c_2, \sigma\rangle \Downarrow \sigma'} \tag{5}$$

$$\frac{\langle \texttt{if }b\texttt{ then }(c\texttt{;while }b\texttt{ do }c)\texttt{ else skip}, \sigma\rangle \Downarrow \sigma'}{\langle \texttt{while }b\texttt{ do }c, \sigma\rangle \Downarrow \sigma'} \tag{6}$$

6.2.2 Boolean Expressions

$$\langle \texttt{true}, \sigma\rangle \Downarrow T \tag{7}$$

$$\langle \texttt{false}, \sigma\rangle \Downarrow F \tag{8}$$

$$\frac{\langle a_1, \sigma\rangle \Downarrow n_1 \qquad \langle a_2, \sigma\rangle \Downarrow n_2}{\langle a_1\texttt{<=}a_2, \sigma\rangle \Downarrow n_1 \leq n_2} \tag{9}$$

$$\frac{\langle b_1, \sigma\rangle \Downarrow p \qquad \langle b_2, \sigma\rangle \Downarrow q}{\langle b_1\texttt{ \&\& }b_2, \sigma\rangle \Downarrow p \wedge q} \tag{10}$$

$$\frac{\langle b_1, \sigma\rangle \Downarrow p \qquad \langle b_2, \sigma\rangle \Downarrow q}{\langle b_1\texttt{ || }b_2, \sigma\rangle \Downarrow p \vee q} \tag{11}$$

$$\frac{\langle b, \sigma\rangle \Downarrow p}{\langle \texttt{!}b, \sigma\rangle \Downarrow \neg p} \tag{12}$$

6.2.3 Arithmetic Expressions

$$\langle n, \sigma\rangle \Downarrow n \tag{13}$$

$$\langle v, \sigma\rangle \Downarrow \sigma(v) \tag{14}$$

$$\frac{\langle a_1, \sigma\rangle \Downarrow n_1 \qquad \langle a_2, \sigma\rangle \Downarrow n_2}{\langle a_1\texttt{ + }a_2, \sigma\rangle \Downarrow n_1 + n_2} \tag{15}$$

$$\frac{\langle a_1, \sigma\rangle \Downarrow n_1 \qquad \langle a_2, \sigma\rangle \Downarrow n_2}{\langle a_1\texttt{ - }a_2, \sigma\rangle \Downarrow n_1 - n_2} \tag{16}$$

$$\frac{\langle a_1, \sigma\rangle \Downarrow n_1 \qquad \langle a_2, \sigma\rangle \Downarrow n_2}{\langle a_1\texttt{ * }a_2, \sigma\rangle \Downarrow n_1 n_2} \tag{17}$$