

# Quiz 4: Operational Semantics of SIMP

EN.601.426/626 Principles of Programming Languages – SP26

Name: \_\_\_\_\_

Suppose we have a (S)imple (IMP)erative language, SIMP, with the following syntax ( $v$ : variable names,  $c$ : constants including integers):

(Expression)	$e ::= v \mid c$	(terminals)
	$e + e \mid e - e \mid e \times e$	(integer operations)
	$e = e \mid e < e \mid e > e$	(bool operations)
(Statement)	$s ::= s ; s$	(sequential)
	$v := e$	(assignment)
	<b>If</b> $e$ { $s$ } <b>Else</b> { $s$ }	(conditional)

1. Please write out a statement computing “absolute” value in the SIMP language. Assume the input is stored in a variable named **in** and the output should be stored in a variable named **out**.

2. The state of the program is represented as a mapping  $\sigma$  from variable names to their integer values (e.g.,  $\sigma = \{\mathbf{in} \mapsto -5, \mathbf{out} \mapsto 5\}$  and  $\sigma(\mathbf{in}) = -5$ ). Assume the semantics of expressions is expressed  $\langle e, \sigma \rangle \Rightarrow y$  where  $y \in \mathbb{Z} \cup \mathbb{B}$  and that of statements is noted as  $\langle s, \sigma \rangle \Downarrow \sigma'$ . Fill in the rules for the assignment and if statements. Use  $\sigma[v \mapsto y]$  to denote  $\sigma$  with  $v$  mapped to (overwritten with)  $y$ .

$$\text{(Sequence)} \quad \frac{\langle s_1, \sigma \rangle \Downarrow \sigma' \quad \langle s_2, \sigma' \rangle \Downarrow \sigma''}{\langle s_1; s_2, \sigma \rangle \Downarrow \sigma''}$$

(Assign) \_\_\_\_\_

(If-True) \_\_\_\_\_ (If-False) \_\_\_\_\_

