

COMP 2049 Languages and Computation Coursework:

Statements in programming languages

Task 1

- $V_2 = \{S_2, E, O\}$
- $T_2 = \{\text{while}, (,), \text{exp}, \text{stmt}\}$
- P_2 is defined as:

$$\begin{aligned}S_2 &\rightarrow \text{while } (E) S \\S &\rightarrow S_2 \mid O \\E &\rightarrow \text{exp} \\O &\rightarrow \text{stmt}\end{aligned}$$

Description:

- **S2** is the start symbol representing the while statement.

Task 2

- $V_3 = \{S_3, E, O, \text{init}, \text{update}\}$
- $T_3 = \{\text{for}, (,), \text{init}, \text{update}, \text{exp}, \text{stmt}\}$
- P_3 is defined as:

$$\begin{aligned}S_3 &\rightarrow \text{for } (\text{init}; E; \text{update}) S \\ \text{init} &\rightarrow \text{exp} \mid \lambda \\ \text{update} &\rightarrow \text{exp} \mid \lambda \\ S &\rightarrow S_3 \mid O \\ E &\rightarrow \text{exp} \mid \lambda \\ O &\rightarrow \text{stmt}\end{aligned}$$

Description::

- **S3** is the start symbol representing the for statement. A for statement consists of the for keyword, followed by an optional initialization (init), an expression E, an optional update (update).
- **init** can either be an initialization (**init**) or empty (λ for optional).
- **update** can either be an update (**update**) or empty (λ for optional).

Task 3

- $V = \{S, E, O, S1, S2, S3, S4, \text{init}, \text{update}\}$
- $T = \{\text{if}, \text{else}, \text{while}, \text{for}, (,), \text{exp}, \text{stmt}, ;, \text{init}, \text{update}\}$

- P is defined as:

$$\begin{aligned}
S &\rightarrow S1 \mid S2 \mid S3 \mid S4 \mid O \\
S1 &\rightarrow \text{if } (E) \ S \\
S2 &\rightarrow \text{if } (E) \ S \ \text{else } S \\
S3 &\rightarrow \text{while } (E) \ S \\
S4 &\rightarrow \text{for } (init; E; update) \ S \\
init &\rightarrow \text{exp} \mid \lambda \\
update &\rightarrow \text{exp} \mid \lambda \\
E &\rightarrow \text{exp} \mid \lambda \\
O &\rightarrow \text{stmt}
\end{aligned}$$

Description:

- **S** represents a statement, which can be an if statement, a while statement, a for statement, or other types of statements.
- **S1** represents an if statement without an else clause. It captures the conditional execution of a statement S when expression E is true.
- **S2** represents an if statement with an else clause. It allows branching into two alternative statements depending on the evaluation of E .
- **S3** represents a while statement.
- **S4** can also represent a for statement, which includes optional components such as initialization, expression, and update parts.
- **init** can either be an initialization (**init**) or empty (λ for optional).
- **update** can either be an update (**update**) or empty (λ for optional).