COMP 2049 Languages and Computation Coursework: Statements in programming languages

Task 1

V_2	=	$\{S_2, E, O\}$ 建议{S2, E, S, O}
T_2	=	$\{while, (,), \text{exp}, \text{stmt}\}$
P_2	is defined as:	
S_2	$\rightarrow$	while $(E)\, S$
S	$\rightarrow$	$S_2 \mid O$
E	$\rightarrow$	exp
O	$\rightarrow$	stmt

Description::

- $S_2 \rightarrow$ while $(E)\, S$: A while statement consists of the keyword `while`, followed by an expression E in parentheses, and then a statement S (which can be a while statement or any other statement).
- $S \rightarrow S_2 \mid O$: A statement S can be a while statement S_2 or another type of statement O.
- $E \rightarrow$ exp: An expression E is represented by `exp`.
- $O \rightarrow$ stmt: A non-while statement is represented by `stmt`.

Task 2

V_3	=	$\{S_3, E, O, F\}$
T_3	=	$\{\text{for}, (,), \text{init}, \text{update}, \text{exp}, \text{stmt}\}$
P_3	is defined as:	
S_3	$\rightarrow$	for $(F; E; F)\, S$
FF	$\rightarrow$	init $\mid$ update $\mid \varepsilon$
E	$\rightarrow$	exp
S	$\rightarrow$	$S_3 \mid O$
O	$\rightarrow$	stmt

Description::

- $S_3 \rightarrow$ for $(F; E; F)\, S$: A for-loop consists of the `for` keyword, followed by an optional initialization F, an expression E, an optional update F, and a statement S.
- $F \rightarrow$ init $\mid$ update $\mid \varepsilon$: The F part can either be an initialization (`init`), an update (`update`), or empty (ε for optional).
- $E \rightarrow$ exp: An expression E is `exp`.
- $S \rightarrow S_3 \mid O$: A statement S can be a for-statement (S_3) or another type of statement O.
- $O \rightarrow$ stmt: A non-for statement is represented by `stmt`.

Task 3

V	$=$	$\{S, E, O, S_1, S_2, S_3, F\}$
T	$=$	$\{\text{if}, \text{else}, \text{while}, \text{for}, (,), \text{exp}, \text{stmt}, ;, \text{init}, \text{update}\}$
P_3	is defined as:	
S	$\rightarrow$	$S_1 \mid S_2 \mid S_3 \mid O$
S_1	$\rightarrow$	$\text{if}\,(E)\,S \mid \text{if}\,(E)\,\text{else}\,S$
S_2	$\rightarrow$	$\text{while}\,(E)\,S$
S_3	$\rightarrow$	$\text{for}\,(F; E; F)\,S$
F	$\rightarrow$	$\text{init} \mid \text{update} \mid \varepsilon$
E	$\rightarrow$	exp
O	$\rightarrow$	stmt

Description:

- $S \rightarrow S_1 \mid S_2 \mid S_3 \mid O$: A statement S can be an `if`, `while`, `for`, or other non-`if`, `while`, or `for` statement.
- $S_1 \rightarrow \text{if}\,(E)\,S \mid \text{if}\,(E)\,\text{else}\,S$: The `if` statement with optional `else`.
- $S_2 \rightarrow \text{while}\,(E)\,S$: The while loop.
- $S_3 \rightarrow \text{for}\,(F; E; F)\,S$: The for loop.
- $F \rightarrow \text{init} \mid \text{update} \mid \varepsilon$: For-initialization or update is optional in the for loop.
- $E \rightarrow \text{exp}$: An expression E is `exp`.
- $O \rightarrow \text{stmt}$: A non-`if`, non-`while`, and non-`for` statement is represented by `stmt`.