Programming Assignment 4

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March 2020

1 Augmented LL(1) Grammar

```
Program -> Declaration-list #END
Declaration-list -> Declaration Declaration-list | EPSILON
Declaration -> Declaration-initial Declaration-prime
Declaration-initial -> Type-specifier #PID ID
Declaration-prime -> #FUNCTION Fun-declaration-prime |
    #VARIABLE Var-declaration-prime
Var-declaration-prime -> ; | #ARRAY [ NUM ] ;
Fun-declaration-prime -> #BEGINSCOPE ( #START_PARAM_COUNTER
    Params #STOP_PARAM_COUNTER ) Compound-stmt #ENDSCOPE
Type-specifier -> int | void
Params -> int #PID ID Param-prime Param-list | void
    Param-list-void-abtar
Param-list-void-abtar -> #PID ID Param-prime Param-list |
    EPSILON
Param-list -> , Param Param-list | EPSILON
Param -> Declaration-initial Param-prime
Param-prime -> #ARRAY #ARRAY_PARAM [ ] | #PARAM EPSILON
Compound-stmt -> { Declaration-list Statement-list }
Statement-list -> Statement Statement-list | EPSILON
Statement -> Expression-stmt | Compound-stmt | Selection-stmt
    | Iteration-stmt | Return-stmt | Switch-stmt
Expression-stmt -> #START_TYPE_CHECK Expression #TYPE_CHECK ;
    | #CONTINUE continue ; | #BREAK break ; | #TYPE_CHECK ;
Selection-stmt -> if ( #START_TYPE_CHECK Expression
    #TYPE_CHECK_IN_BRACKETS ) Statement else Statement
Iteration-stmt -> while #ENTER_WHILE ( #START_TYPE_CHECK
    Expression #TYPE_CHECK_IN_BRACKETS ) Statement #EXIT_WHILE
Return-stmt -> return Return-stmt-prime
Return-stmt-prime -> ; | #START_TYPE_CHECK Expression
    #TYPE_CHECK ;
Switch-stmt -> switch #ENTER_SWITCH_CASE ( #START_TYPE_CHECK
    Expression #TYPE_CHECK_IN_BRACKETS ) { Case-stmts
    Default-stmt } #EXIT_SWITCH_CASE
Case-stmts -> Case-stmt Case-stmts | EPSILON
Case-stmt -> case NUM : Statement-list
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Default-stmt -> default : Statement-list | EPSILON
Expression -> Simple-expression-zegond | #USE_PID
    #ADD_TO_TYPE_CHECK ID B
B -> #NOT_FUNCTION_CALL = Expression | #NOT_FUNCTION_CALL [
    #INDEXING #START_TYPE_CHECK Expression #TYPE_CHECK ] H |
    Simple-expression-prime
H -> = Expression | G D C
Simple-expression-zegond -> Additive-expression-zegond C
Simple-expression-prime -> Additive-expression-prime C
C -> Relop Additive-expression | EPSILON
Relop -> < | ==
Additive-expression -> Term D
Additive-expression-prime -> Term-prime D
Additive-expression-zegond -> Term-zegond D
D -> Addop Term D | EPSILON
Addop -> + | -
Term -> Factor G
Term-prime -> Factor-prime G
Term-zegond -> Factor-zegond G
G -> * Factor G | EPSILON
Factor -> ( #START_TYPE_CHECK Expression
    #TYPE_CHECK_IN_BRACKETS ) | #USE_PID #ADD_TO_TYPE_CHECK
    ID Var-call-prime | #ADD_TO_TYPE_CHECK NUM
Var-call-prime -> #FUNCTION_CALL ( #START_ARGUMENT_COUNTER
    Args #STOP_ARGUMENT_COUNTER ) | #NOT_FUNCTION_CALL
    Var-prime
Var-prime -> [ #INDEXING #START_TYPE_CHECK Expression
    #TYPE_CHECK ] | EPSILON
Factor-prime -> #FUNCTION_CALL ( #START_ARGUMENT_COUNTER Args
    #STOP_ARGUMENT_COUNTER ) | #NOT_FUNCTION_CALL EPSILON
Factor-zegond -> ( #START_TYPE_CHECK Expression
    #TYPE_CHECK_IN_BRACKETS ) | #ADD_TO_TYPE_CHECK NUM
Args -> Arg-list | EPSILON
Arg-list -> #ARGUMENT #START_TYPE_CHECK Expression
    #TYPE_CHECK Arg-list-prime
Arg-list-prime -> , #ARGUMENT #START_TYPE_CHECK Expression
    #TYPE_CHECK Arg-list-prime | EPSILON
```

2 Error Detection

Our lexical analyzer can detect all of the 8 error types listed in the assignment.