Programming Assignment 5

Leo Kivikunnas 525925, Jaakko koskela 526050

April 2020

1 Augmented LL(1) Grammar

```
Program -> #START 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 [ #ARRAY_SIZE 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 #STATEMENTS_BEGIN
    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 ) #SAVE Statement else #JPF_SAVE
    Statement #JP
Iteration-stmt -> while #ENTER_WHILE ( #START_TYPE_CHECK
    Expression #TYPE_CHECK_IN_BRACKETS ) #SAVE Statement
    #EXIT_WHILE
Return-stmt -> return Return-stmt-prime #RETURN
Return-stmt-prime -> ; #EMPTY_RETURN | #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 #IMMEDIATE NUM #SAVE_CASE : Statement-list
Default-stmt -> default : #DEFAULT_CASE Statement-list |
    EPSILON
Expression -> Simple-expression-zegond | #USE_PID
    #ADD_TO_TYPE_CHECK ID B
B -> #NOT_FUNCTION_CALL #ASSIGNMENT_CHAIN = Expression
    #ASSIGN | #NOT_FUNCTION_CALL [ #INDEXING
    #START_TYPE_CHECK Expression #TYPE_CHECK #INDEXING_DONE ]
    H | Simple-expression-prime
H -> #ASSIGNMENT_CHAIN = Expression #ASSIGN | G D C
Simple-expression-zegond -> Additive-expression-zegond C
Simple-expression-prime -> Additive-expression-prime C
C -> Relop Additive-expression #RELOP | EPSILON
Relop -> < #LT | == #EQ
Additive-expression -> Term D
Additive-expression-prime -> Term-prime D
Additive-expression-zegond -> Term-zegond D
D -> Addop Term #ADDOP D | EPSILON
Addop -> #PLUS + | #MINUS -
Term -> Factor G
Term-prime -> Factor-prime G
Term-zegond -> Factor-zegond G
G -> * Factor #MULT 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 #IMMEDIATE NUM
Var-call-prime -> #FUNCTION_CALL ( #START_ARGUMENT_COUNTER
    Args #STOP_ARGUMENT_COUNTER ) #FUNCTION_CALLED |
    #NOT_FUNCTION_CALL Var-prime
Var-prime -> [ #INDEXING #START_TYPE_CHECK Expression
    #TYPE_CHECK #INDEXING_DONE ] | EPSILON
Factor-prime -> #FUNCTION_CALL ( #START_ARGUMENT_COUNTER Args
    #STOP_ARGUMENT_COUNTER ) #FUNCTION_CALLED |
    #NOT_FUNCTION_CALL EPSILON
Factor-zegond -> ( #START_TYPE_CHECK Expression
    #TYPE_CHECK_IN_BRACKETS ) | #ADD_TO_TYPE_CHECK #IMMEDIATE
    NUM
Args -> Arg-list | EPSILON
Arg-list -> #ARGUMENT #START_TYPE_CHECK Expression
    #ARGUMENT_TO_PASS #TYPE_CHECK Arg-list-prime
Arg-list-prime -> , #ARGUMENT #START_TYPE_CHECK Expression
    #ARGUMENT_TO_PASS #TYPE_CHECK Arg-list-prime | EPSILON
```

2 Intermediate Code generation

Our intermediate code generator can handle all the compulsory requirements. Additionally, we implemented code generation for nested scopes as specified in the second extra requirement.