Chaga Programming Language

BNF grammar

Version: 1.0 (work-in-progress)

```
<CHARACTER> ::=    | ! | # | $ | % | & | ( | ) | * | + | , | - | . | / | 0 | 1 | 2 | 3 | 4
    | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? | @ | A | B | C | D | E | F | G | H | I | J
    | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | [ | ] | ^ | _ | ` | a
    | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w
    | x | y | z | { | | | } | ~

<ESCAPED_CHARACTER> ::= \a | \b | \f | \n | \r | \t | \v | \\ | \? | \' | \" | \
    x<HEX_DIGIT> | \x<HEX_DIGIT><HEX_DIGIT>

<LETTER> ::= A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T
    | U | V | W | X | Y | Z | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p
    | q | r | s | t | u | v | w | x | y | z

<DIGIT> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

<NON_ZERO_DIGIT> ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

<HEX_DIGIT> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F | a | b | c
    | d | e | f

<L_PAREN> ::= (

<R_PAREN> ::= )

<L_BRACKET> ::= [

<R_BRACKET> ::= ]

<L_BRACE> ::= {

<R_BRACE> ::= }

<DOUBLE_QUOTE> ::= "

<SINGLE_QUOTE> ::= '

<SEMICOLON> ::= ;

<COMMA> ::= ,

<PERIOD> ::= .

<ASSIGNMENT_OPERATOR> ::= =

<PLUS> ::= +

<MINUS> ::= -
```

<ASTERISK> ::= *

<DIVIDE> ::= /

<MODULO> ::= %

<CARET> ::= ^

<LT> ::= <

<GT> ::= >

<LT_EQUAL> ::= <=

<GT_EQUAL> ::= >=

<BOOLEAN_AND> ::= &&

<BOOLEAN_OR> ::= ||

<BOOLEAN_NOT> ::= !

<BOOLEAN_EQUAL> ::= ==

<BOOLEAN_NOT_EQUAL> ::= !=

<BOOLEAN_TRUE> ::= TRUE

<BOOLEAN_FALSE> ::= FALSE

<STRING> ::= <CHARACTER> | <ESCAPED_CHARACTER> | <CHARACTER> <STRING> |
    <ESCAPED_CHARACTER> <STRING>

<DOUBLE_QUOTED_STRING> ::= <DOUBLE_QUOTE> <STRING> <DOUBLE_QUOTE>

<SINGLE_QUOTED_STRING> ::= <SINGLE_QUOTE> <STRING> <SINGLE_QUOTE>

<QUOTED_STRING> ::= <DOUBLE_QUOTED_STRING> | <SINGLE_QUOTED_STRING>

<UNDERSCORE> ::= _

<LETTER_UNDERSCORE> ::= <LETTER> | <UNDERSCORE>

<LETTER_DIGIT_UNDERSCORE> ::= <LETTER> | <DIGIT> | <UNDERSCORE>

<POSITIVE_INTEGER_EXPONENT_TAIL> ::= <DIGIT> | <DIGIT> <POSITIVE_INTEGER_EXPONENT_TAIL>

<POSITIVE_INTEGER_WITH_EXPONENT_LOWERCASE_E> ::=
    <POSITIVE_INTEGER_NO_EXPONENT>e<POSITIVE_INTEGER_EXPONENT_TAIL>

<POSITIVE_INTEGER_WITH_EXPONENT_UPPERCASE_E> ::=
    <POSITIVE_INTEGER_NO_EXPONENT>E<POSITIVE_INTEGER_EXPONENT_TAIL>

<POSITIVE_INTEGER_WITH_EXPONENT> ::= <POSITIVE_INTEGER_WITH_EXPONENT_LOWERCASE_E> |
    <POSITIVE_INTEGER_WITH_EXPONENT_UPPERCASE_E>

<NON_NEGATIVE_INTEGER_NO_EXPONENT> ::= <DIGIT> | <DIGIT>
    <NON_NEGATIVE_INTEGER_NO_EXPONENT>

<POSITIVE_INTEGER_NO_EXPONENT> ::= <NON_NEGATIVE_INTEGER_NO_EXPONENT> <NON_ZERO_DIGIT> |
    <NON_ZERO_DIGIT> <NON_NEGATIVE_INTEGER_NO_EXPONENT>

<POSITIVE_INTEGER> ::= <POSITIVE_INTEGER_NO_EXPONENT> | <POSITIVE_INTEGER_WITH_EXPONENT>

<INTEGER_EXPONENT> ::= <DIGIT> | <DIGIT><INTEGER_EXPONENT>

<INTEGER_UNSIGNED_WITH_EXPONENT> ::= <INTEGER_UNSIGNED>e<INTEGER_EXPONENT> |
    <INTEGER_UNSIGNED>E<INTEGER_EXPONENT>

<INTEGER_UNSIGNED> ::= <DIGIT> | <DIGIT><INTEGER_UNSIGNED>

<INTEGER> ::= <INTEGER_UNSIGNED> | <PLUS><INTEGER_UNSIGNED> | <MINUS><INTEGER_UNSIGNED> |
    <INTEGER_UNSIGNED_WITH_EXPONENT> | <PLUS><INTEGER_UNSIGNED_WITH_EXPONENT> |
    <MINUS><INTEGER_UNSIGNED_WITH_EXPONENT>

<FLOAT_WITH_EXPONENT_TAIL> ::= <DIGIT> | <DIGIT><FLOAT_DECIMAL_EXPONENT_TAIL>

<FLOAT_WITH_POSITIVE_EXPONENT_LOWERCASE_E> ::=
    <FLOAT_NO_EXPONENT>e<PLUS><FLOAT_DECIMAL_EXPONENT_TAIL>

<FLOAT_WITH_NEGATIVE_EXPONENT_LOWERCASE_E> ::=
    <FLOAT_NO_EXPONENT>e<MINUS><FLOAT_DECIMAL_EXPONENT_TAIL>

<FLOAT_WITH_POSITIVE_EXPONENT_UPPERCASE_E> ::=
    <FLOAT_NO_EXPONENT>E<PLUS><FLOAT_DECIMAL_EXPONENT_TAIL>

<FLOAT_WITH_NEGATIVE_EXPONENT_UPPERCASE_E> ::=
    <FLOAT_NO_EXPONENT>E<MINUS><FLOAT_DECIMAL_EXPONENT_TAIL>

<FLOAT_DECIMAL_TAIL> ::= <DIGIT> | <DIGIT><FLOAT_DECIMAL_TAIL>

<FLOAT_DECIMAL> ::= <PERIOD> | <PERIOD><FLOAT_DECIMAL_TAIL>

<FLOAT_TAIL> ::= <FLOAT_DECIMAL> | <DIGIT><FLOAT_TAIL>

<FLOAT_NO_EXPONENT> ::= <DIGIT><FLOAT_TAIL> | <PLUS><FLOAT_TAIL> | <MINUS><FLOAT_TAIL>

<FLOAT> ::= <FLOAT_NO_EXPONENT> | <FLOAT_WITH_POSITIVE_EXPONENT_LOWERCASE_E> |
    <FLOAT_WITH_POSITIVE_EXPONENT_UPPERCASE_E> | <FLOAT_WITH_NEGATIVE_EXPONENT_LOWERCASE_E>
    | <FLOAT_WITH_NEGATIVE_EXPONENT_UPPERCASE_E>

<NUMBER> ::= <INTEGER> | <FLOAT> | <IMAGINARY_NUMBER> | <COMPLEX_NUMBER>

<IDENTIFIER_TAIL> ::= <LETTER_DIGIT_UNDERSCORE> | <LETTER_DIGIT_UNDERSCORE>
    <IDENTIFIER_TAIL>

<IDENTIFIER> ::= <LETTER_UNDERSCORE> | <LETTER_UNDERSCORE> <INDENTIFIER_TAIL>

<IDENTIFIER_LIST> ::= <IDENTIFIER> | <IDENTIFIER> <COMMA> <IDENTIFIER_LIST>

<IDENTIFIER_ARRAY_LIST> ::= <IDENTIFIER> <L_BRACKET> <POSITIVE_INTEGER> <R_BRACKET> |
    <IDENTIFIER> <L_BRACKET> <POSITIVE_INTEGER> <R_BRACKET> <COMMA> <IDENTIFIER_ARRAY_LIST>

<IDENTIFIER_AND_IDENTIFIER_ARRAY_LIST> ::= <IDENTIFIER_LIST> | <IDENTIFIER_ARRAY_LIST> |
    <IDENTIFIER_LIST> <IDENTIFIER_ARRAY_LIST> | <IDENTIFIER_ARRAY_LIST> <IDENTIFIER_LIST>

<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST> ::= <IDENTIFIER> | <IDENTIFIER>
    <L_BRACKET> <IDENTIFIER> <R_BRACKET> | <IDENTIFIER> <COMMA>
    <IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST> | <IDENTIFIER> <L_BRACKET>
    <IDENTIFIER> <R_BRACKET> <COMMA> <IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST> |
    <IDENTIFIER> <L_BRACKET> <NUMERICAL_EXPRESSION> <R_BRACKET> | <IDENTIFIER> <L_BRACKET>
    <NUMERICAL_EXPRESSION> <R_BRACKET> <COMMA>
    <IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST>

\<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION\> ::= \<IDENTIFIER\> |
    \<IDENTIFIER\> \<L_BRACKET\> \<POSITIVE_INTEGER\> \<R_BRACKET\> | \<IDENTIFIER\> \<COMMA\>
    \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION\> | \<IDENTIFIER\> \<L_BRACKET\>
    \<POSITIVE_INTEGER\> \<R_BRACKET\> \<COMMA\>
    \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION\> | \<IDENTIFIER\> \<L_BRACKET\>
    \<POSITIVE_INTEGER\> \<R_BRACKET\> | \<IDENTIFIER\> \<L_BRACKET\> \<POSITIVE_INTEGER\>
    \<R_BRACKET\> \<COMMA\> \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION\>

\<DATATYPE_SPECIFIER\> ::= bool | char | string | date | time | datetime | int | float |
    complex | imaginary | file | pointer | enum \<IDENTIFIER_AND_IDENTIFIER_ARRAY\> | struct
    \<IDENTIFIER_AND_IDENTIFIER_ARRAY\>

\<NUMERICAL_OPERAND\> ::= \<IDENTIFIER\> | \<NUMBER\> |\<IDENTIFIER\> \<L_BRACKET\> \<NUMERICAL
    EXPRESSION\> \<R_BRACKET\> | \<GETCHAR_FUNCTION\> | \<USER_DEFINED_FUNCTION\> | \<SINGLE_QUOTE\>
    \<CHARACTER\> \<SINGLE_QUOTE\> | \<SINGLE_QUOTE\> \<ESCAPED_CHARACTER\> \<SINGLE_QUOTE\> |
    \<DOUBLE_QUOTE\> \<CHARACTER\> \<DOUBLE_QUOTE\> | \<DOUBLE_QUOTE\> \<ESCAPED_CHARACTER\>
    \<DOUBLE_QUOTE\>

\<NUMERICAL_OPERATOR\> ::= \<PLUS\> | \<MINUS\> | \<ASTERISK\> | \<DIVIDE\> | \<MODULO\> | \<CARET\>

\<BOOLEAN_OPERATOR\> ::= \<BOOLEAN_AND\> | \<BOOLEAN_OR\>

\<RELATIONAL_OPERATOR\> ::= \<LT\> | \<LT_EQUAL\> | \<GT\> | \<GT_EQUAL\> | \<BOOLEAN_EQUAL\> |
    \<BOOLEAN_NOT_EQUAL\>

\<NUMERICAL_OPERAND_WITH_UNARY_MINUS\> ::= \<MINUS\> \<NUMERICAL_OPERAND\>

\<NUMERICAL_OPERAND_WITH_UNARY_PLUS\> ::= \<PLUS\> \<NUMERICAL_OPERAND\>

\<NUMERICAL_OPERAND_WITH_UNARY_PLUS_OR_MINUS\> ::= \<NUMERICAL_OPERAND_WITH_UNARY_MINUS\> |
    \<NUMERICAL_OPERAND_WITH_UNARY_PLUS\>

\<NUMERICAL_OPERAND_WITH_UNARY_OPERATOR_INSIDE_PARENTHESIS_TAIL\> ::= \<L_PAREN\>
    \<NUMERICAL_OPERAND_WITH_UNARY_PLUS_OR_MINUS\> \<R_PAREN\>

\<NUMERICAL_OPERAND_WITH_UNARY_OPERATOR_INSIDE_PARENTHESIS\> ::=
    \<NUMERICAL_OPERAND_WITH_UNARY_OPERATOR_INSIDE_PARENTHESIS_TAIL\> | \<L_PAREN\>
    \<NUMERICAL_OPERAND_WITH_UNARY_OPERATOR_INSIDE_PARENTHESIS\> \<R_PAREN\>

\<NUMERICAL_OPERAND_INSIDE_PARENTHESIS_TAIL\> ::= \<L_PAREN\>
    \<NUMERICAL_OPERAND_WITH_UNARY_PLUS_OR_MINUS\> \<R_PAREN\>

\<NUMERICAL_OPERAND_INSIDE_PARENTHESIS\> ::= \<NUMERICAL_OPERAND_INSIDE_PARENTHESIS_TAIL\> |
    \<L_PAREN\> \<NUMERICAL_OPERAND_INSIDE_PARENTHESIS\> \<R_PAREN\>

\<NUMERICAL_OPERAND_ALL\> ::= \<NUMERICAL_OPERAND\> | \<NUMERICAL_OPERAND_INSIDE_PARENTHESIS\> |
    \<NUMERICAL_OPERAND_WITH_UNARY_PLUS_OR_MINUS\> |
    \<NUMERICAL_OPERAND_WITH_UNARY_OPERATOR_INSIDE_PARENTHESIS\>

\<NUMERICAL_EXPRESSION_SINGLE_TERM\> ::= \<NUMERICAL_OPERAND_ALL\>

\<NUMERICAL_EXPRESSION_MULTI_TERM\> ::= \<NUMERICAL_OPERAND_ALL\> \<NUMERICAL_OPERATOR\>
    \<NUMERICAL_EXPRESSION\>

\<NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_TAIL\> ::= \<L_PAREN\>
    \<NUMERICAL_EXPRESSION_MULTI_TERM\> \<R_PAREN\>

\<NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS\> ::=
    \<NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_TAIL\> | \<L_PAREN\>
    \<NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS\> \<R_PAREN\>

<NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_AND_TERM_OUTSIDE_PARENTHESIS> ::=
    <NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> <NUMERICAL_OPERATOR>
    <NUMERICAL_EXPRESSION>

<NUMERICAL_EXPRESSION> ::= <NUMERICAL_EXPRESSION_SINGLE_TERM> |
    <NUMERICAL_EXPRESSION_MULTI_TERM> |
    <NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> |
    <NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_AND_TERM_OUTSIDE_PARENTHESIS>

<BOOLEAN_OPERAND> ::= <BOOLEAN_TRUE> | <BOOLEAN_FALSE> | <NUMERICAL_OPERAND>

<BOOLEAN_OPERAND_INSIDE_PARENTHESIS_TAIL> ::= <L_PAREN> <BOOLEAN_OPERAND> <R_PAREN>

<BOOLEAN_OPERAND_INSIDE_PARENTHESIS> ::= <BOOLEAN_OPERAND_INSIDE_PARENTHESIS_TAIL> |
    <L_PAREN> <BOOLEAN_OPERAND_INSIDE_PARENTHESIS> <R_PAREN>

<BOOLEAN_OPERAND_WITH_UNARY_NOT> ::= <BOOLEAN_NOT> <BOOLEAN_OPERAND>

<BOOLEAN_OPERAND_WITH_UNARY_NOT_INSIDE_PARENTHESIS_TAIL> ::= <L_PAREN> <BOOLEAN_NOT>
    <BOOLEAN_OPERAND> <R_PAREN>

<BOOLEAN_OPERAND_WITH_UNARY_NOT_INSIDE_PARENTHESIS> ::=
    <BOOLEAN_OPERAND_WITH_UNARY_NOT_INSIDE_PARENTHESIS_TAIL> | <L_PAREN>
    <BOOLEAN_OPERAND_WITH_UNARY_NOT_INSIDE_PARENTHESIS> <R_PAREN>

<BOOLEAN_OPERAND_ALL> ::= <BOOLEAN_OPERAND> | <BOOLEAN_OPERAND_INSIDE_PARENTHESIS> |
    <BOOLEAN_OPERAND_WITH_UNARY_NOT> | <BOOLEAN_OPERAND_WITH_UNARY_NOT_INSIDE_PARENTHESIS>

<BOOLEAN_EXPRESSION_SINGLE_TERM> ::= <BOOLEAN_OPERAND_ALL>

<BOOLEAN_EXPRESSION_MULTI_TERM> ::= <BOOLEAN_OPERAND_ALL> <BOOLEAN_OPERATOR>
    <BOOLEAN_EXPRESSION> | <NUMERICAL_EXPRESSION> <RELATIONAL_OPERATOR>
    <NUMERICAL_EXPRESSION>

<BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_TAIL> ::= <L_PAREN>
    <BOOLEAN_EXPRESSION_MULTI_TERM> <R_PAREN>

<BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> ::=
    <BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_TAIL> | <L_PAREN>
    <BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> <R_PAREN>

<BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_AND_TERM_OUTSIDE_PARENTHESIS> ::=
    <BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> <BOOLEAN_OPERATOR>
    <BOOLEAN_EXPRESSION> | <NUMERICAL_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS>
    <RELATIONAL_OPERATOR> <NUMERICAL_EXPRESSION>

<BOOLEAN_EXPRESSION> ::= <BOOLEAN_EXPRESSION_SINGLE_TERM> |
    <BOOLEAN_EXPRESSION_MULTI_TERM> | <BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS> |
    <BOOLEAN_EXPRESSION_MULTI_TERM_INSIDE_PARENTHESIS_AND_TERM_OUTSIDE_PARENTHESIS>

<EXPRESSION> ::= <BOOLEAN_EXPRESSION> | <NUMERICAL_EXPRESSION>

<ASSIGNMENT_EXPRESSION> ::= <BOOLEAN_EXPRESSION> | <NUMERICAL_EXPRESSION> |
    <FUNCTION_CALL>

<CASE_CHARACTER_CONSTANT> ::= <CHARACTER> | <ESCAPED_CHARACTER>

<CASE_CONSTANT> ::= <SINGLE_QUOTE> <CASE_CHARACTER_CONSTANT> <SINGLE_QUOTE> |
    <DOUBLE_QUOTE> <CASE_CHARACTER_CONSTANT> <DOUBLE_QUOTE> | <NUMBER>

<BREAK_STATEMENT> ::= break;

<STATEMENT_BLOCK_WITHOUT_BRACES_LAST_STATEMENT_BREAK> ::=
    <STATEMENT_BLOCK_WITHOUT_BRACES> <BREAK_STATEMENT> <SEMICOLON>

<DEFAULT_CASE_STATEMENT_TAIL> ::= <STATEMENT_BLOCK_WITHOUT_BRACES> |
    <STATEMENT_BLOCK_WITHOUT_BRACES_LAST_STATEMENT_BREAK>

<DEFAULT_CASE_STATEMENT> ::= default: <DEFAULT_CASE_STATEMENT_TAIL>

<CASE_STATEMENT_PRECEDES_DEFAULT_CASE_STATEMENT> ::= case <CASE_CONSTANT>:
    <CASE_STATEMENT_TAIL> <DEFAULT_CASE_STATEMENT>

<CASE_STATEMENT_FOLLOWS_DEFAULT_CASE_STATEMENT> ::= <DEFAULT_CASE_STATEMENT> case
    <CASE_CONSTANT>: <CASE_STATEMENT_TAIL>

<CASE_STATEMENT> ::= <CASE_STATEMENT_PRECEDES_DEFAULT_CASE_STATEMENT> |
    <CASE_STATEMENT_FOLLOWS_DEFAULT_CASE_STATEMENT> | <DEFAULT_CASE_STATEMENT>

<SWITCH_SELECTION_STATEMENT> ::= switch { <CASE_STATEMENT> }

<THEN_STATEMENT_BLOCK> ::= then <BLOCK_STATEMENT>

<THEN_ELSE_STATEMENT_BLOCK> ::= then <BLOCK_STATEMENT> else <BLOCK_STATEMENT>

<IF_SELECTION_STATEMENT_TAIL> ::= <THEN_STATEMENT_BLOCK> | <THEN_ELSE_STATEMENT_BLOCK>

<IF_SELECTION_STATEMENT> ::= if <L_PAREN> <BOOLEAN_EXPRESSION> <R_PAREN>
    <IF_SELECTION_STATEMENT_TAIL>

<SELECTION_STATEMENT> ::= <IF_SELECTION_STATEMENT> | <SWITCH_SELECTION_STATEMENT>

<DO_BLOCK_STATEMENT> ::= do <BLOCK_STATEMENT>

<FOR_STATEMENT_TAIL> ::= <R_PAREN> <DO_BLOCK_STATEMENT> | step <INTEGER_OR_FLOAT>
    <R_PAREN> <DO_BLOCK_STATEMENT>

<FOR_STATEMENT> ::= for <L_PAREN> <IDENTIFIER> = <INTEGER_OR_FLOAT> to <INTEGER_OR_FLOAT>
    <FOR_STATEMENT_TAIL>

<DO_WHILE_STATEMENT> ::= <DO_BLOCK_STATEMENT> while <L_PAREN> <BOOLEAN_EXPRESSION>
    <R_PAREN> <SEMICOLON>

<WHILE_STATEMENT> ::= while <L_PAREN> <BOOLEAN_EXPRESSION> <R_PAREN> <DO_BLOCK_STATEMENT>

<ITERATION_STATEMENT> ::= <FOR_STATEMENT> | <WHILE_STATEMENT> | <DO_WHILE_STATEMENT>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_READONLY_UPPERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>R<DOUBLE_QUOTE> <SEMICOLON>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_READONLY_LOWERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>r<DOUBLE_QUOTE> <SEMICOLON>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_WRITEONLY_UPPERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>W<DOUBLE_QUOTE> <SEMICOLON>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_WRITEONLY_LOWERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>w<DOUBLE_QUOTE> <SEMICOLON>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_READWRITE_UPPERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>RW<DOUBLE_QUOTE> <SEMICOLON>

<ASSIGNMENT_STATEMENT_ATTRIBUTE_READWRITE_LOWERCASE> ::= set <IDENTIFIER><PERIOD>protect
    <ASSIGNMENT_OPERATOR> <DOUBLE_QUOTE>rw<DOUBLE_QUOTE> <SEMICOLON>

\<ASSIGNMENT_STATEMENT_SET_PRIVATE_ATTRIBUTE\> ::=
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_READONLY_UPPERCASE\> |
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_READONLY_LOWERCASE\> |
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_WRITEONLY_UPPERCASE\> |
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_WRITEONLY_LOWERCASE\> |
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_READWRITE_UPPERCASE\> |
 \<ASSIGNMENT_STATEMENT_ATTRIBUTE_READWRITE_LOWERCASE\>

\<ASSIGNMENT_STATEMENT\> ::= set \<IDENTIFIER\> \<ASSIGNMENT_OPERATOR\> \<ASSIGNMENT_EXPRESSION\>
 \<SEMICOLON\>

\<PRINT_STATEMENT_TAIL\> ::= \<QUOTED_STRING\> \<R_PAREN\> \<SEMICOLON\> | \<IDENTIFIER\> \<R_PAREN\>
 \<SEMICOLON\>

\<PRINT_STATEMENT\> ::= print \<L_PAREN\> \<PRINT_STATEMENT_TAIL\>

\<PRINTF_STATEMENT\> ::= printf \<L_PAREN\> \<QUOTED_STRING\> \<R_PAREN\> \<SEMICOLON\> | print
 \<L_PAREN\> \<DOUBLE_QUOTED_STRING\> \<COMMA\>
 \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST\> \<R_PAREN\> \<SEMICOLON\> | print
 \<L_PAREN\> \<SINGLE_QUOTED_STRING\> \<COMMA\>
 \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST\> \<R_PAREN\> \<SEMICOLON\>

\<GETCHAR_FUNCTION\> ::= getchar \<L_PAREN\> void \<R_PAREN\>

\<USER_DEFINED_FUNCTION\> ::= \<IDENTIFIER\> \<L_PAREN\>
 \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST\> \<R_PAREN\> | \<IDENTIFIER\> \<L_PAREN\>
 \<EXPRESSION\> \<R_PAREN\>

\<USER_DEFINED_PROCEDURE_CALL_STATEMENT\> ::= \<IDENTIFIER\> \<L_PAREN\>
 \<IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST\> \<R_PAREN\> \<SEMICOLON\> | \<IDENTIFIER\>
 \<L_PAREN\> \<EXPRESSION\> \<R_PAREN\> \<SEMICOLON\>

\<DECLARATION_STATEMENT\> ::= declare \<DATATYPE_SPECIFIER\> \<IDENTIFIER\> \<SEMICOLON\> |
 declare \<DATATYPE_SPECIFIER\> \<IDENTIFIER_AND_IDENTIFIER_ARRAY_LIST\> \<SEMICOLON\>

\<RETURN_STATEMENT_PARAMETER_VARIABLE_OR_ARRAY\> ::= \<IDENTIFIER\> | \<IDENTIFIER\> \<L_BRACKET\>
 \<IDENTIFIER\> \<R_BRACKET\>

\<RETURN_STATEMENT_PARAMETER\> ::= \<IDENTIFIER\> | \<IDENTIFIER\> \<L_BRACKET\> \<IDENTIFIER\>
 \<R_BRACKET\> | \<IDENTIFIER\> \<L_BRACKET\> \<IDENTIFIER\> \<COMMA\> \<IDENTIFIER\> \<R_BRACKET\> |
 \<IDENTIFIER\> \<L_BRACKET\> \<IDENTIFIER\> \<COMMA\> \<IDENTIFIER\> \<COMMA\> \<IDENTIFIER\>
 \<R_BRACKET\>

\<RETURN_STATEMENT_PARAMETER_LIST_TAIL\> ::= \<RETURN_STATEMENT_PARAMETER\> |
 \<RETURN_STATEMENT_PARAMETER_LIST\>

\<RETURN_STATEMENT_PARAMETER_LIST\> ::= \<RETURN_STATEMENT_PARAMETER\> \<COMMA\>
 \<RETURN_STATEMENT_PARAMETER_LIST_TAIL\>

\<RETURN_STATEMENT_TAIL\> ::= \<RETURN_STATEMENT_PARAMETER\> \<SEMICOLON\> | \<L_PAREN\>
 \<RETURN_STATEMENT_PARAMETER_LIST\> \<R_PAREN\> \<SEMICOLON\>

\<RETURN_STATEMENT\> ::= return \<RETURN_STATEMENT_TAIL\>

\<STATEMENT\> ::= \<DECLARATION_STATEMENT\> | \<ASSIGNMENT_STATEMENT\> |
 \<ASSIGNMENT_STATEMENT_SET_PRIVATE_ATTRIBUTE\> | \<ITERATION_STATEMENT\> |
 \<SELECTION_STATEMENT\> | \<PRINT_STATEMENT\> | \<RETURN_STATEMENT_SINGLE_ELEMENT\> |
 \<RETURN_STATEMENT_MULTI_ELEMENT\> | \<USER_DEFINED_PROCEDURE_CALL_STATEMENT\>

\<COMPOUND_STATEMENT\> ::= \<STATEMENT\> | \<STATEMENT\> \<COMPOUND_STATEMENT\>

<BLOCK_STATEMENT> ::= <L_BRACE> <COMPOUND_STATEMENT> <R_BRACE> | <L_BRACE> <R_BRACE>

<MAIN_PARAMETER_LIST> ::= void | pointer argv, int argc

<FUNCTION_RETURN_PARAMETER_LIST_TAIL> ::= <DATATYPE_SPECIFIER>

<FUNCTION_RETURN_PARAMETER_LIST> ::= <FUNCTION_RETURN_PARAMETER_LIST_TAIL> |
   <DATATYPE_SPECIFIER> <COMMA> <FUNCTION_RETURN_PARAMETER_LIST>

<PARAMETER_LIST_TAIL> ::= <DATATYPE_SPECIFIER> <IDENTIFIER> | <DATATYPE_SPECIFIER>
   <IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION> | <DATATYPE_SPECIFIER>
   <IDENTIFIER> <PARAMETER_LIST_TAIL> | <DATATYPE_SPECIFIER>
   <IDENTIFIER_AND_IDENTIFIER_ARRAY_PARAMETER_LIST_DECLARATION> <PARAMETER_LIST_TAIL>

<PARAMETER_LIST> ::= void | <PARAMETER_LIST_TAIL>

<FUNCTION_DEFINITION> ::= define function <IDENTIFIER> <L_PAREN> <PARAMETER_LIST>
   <R_PAREN> return <L_PAREN> <PARAMETER_LIST_TAIL> <R_PAREN>

<PROCEDURE_DEFINITION> ::= define procedure <IDENTIFIER> <L_PAREN> <PARAMETER_LIST>
   <R_PAREN> <L_BRACE> <COMPOUND_STATEMENT> <R_BRACE>

<MAIN_PROCEDURE_DEFINITION> ::= define procedure main <L_PAREN> <MAIN_PARAMETER_LIST>
   <R_PAREN> <BLOCK_STATEMENT>

<PROGRAM_TAIL> ::= <FUNCTION_DEFINITION> | <PROCEDURE_DEFINITION> |
   <DECLARATION_STATEMENT> | <FUNCTION_DECLARATION> <PROGRAM_TAIL> |
   <PROCEDURE_DEFINITION> <PROGRAM_TAIL> | <DECLARATION_STATEMENT> <PROGRAM_TAIL>

<PROGRAM> ::= <MAIN_PROCEDURE_DEFINITION> | <MAIN_PROCEDURE_DEFINITION> <PROGRAM_TAIL> |
   <FUNCTION_DEFINITION> <PROGRAM> | <PROCEDURE_DEFINITION> <PROGRAM> |
   <DECLARATION_STATEMENT> <PROGRAM>

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