

Compiler Theory Project (Milestone 2)

Team 21

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Context-Free Grammar for Tiny Programming Language

1. Terminals

DIGIT	$\rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$
LETTER	$\rightarrow a \mid b \mid c \mid \dots \mid z \mid A \mid B \mid C \mid \dots \mid Z$
CHAR	\rightarrow LETTER DIGIT special characters
ARITH_OP	$\rightarrow + \mid - \mid * \mid /$
COND_OP	$\rightarrow < \mid > \mid = \mid <>$
BOOL_OP	$\rightarrow \&\& \mid $
ASSIGN_OP	$\rightarrow :=$
COMMA	$\rightarrow ,$
SEMICOLON	$\rightarrow ;$
LEFT_PAREN	$\rightarrow ($
RIGHT_PAREN	$\rightarrow)$
LEFT_BRACE	$\rightarrow \{$
RIGHT_BRACE	$\rightarrow \}$
QUOTE	$\rightarrow "$
DOT	$\rightarrow .$
COMMENT_START	$\rightarrow /*$
COMMENT_END	$\rightarrow */$

2. Production Rules

1) Number

Number \rightarrow DIGIT Number_Tail
Number_Tail \rightarrow DIGIT Number_Tail | DOT DIGIT Number_Tail | ϵ

2) String

```
String → QUOTE Char_Sequence QUOTE  
Char_Sequence → CHAR Char_Sequence | ε
```

3) Reserved Keywords

```
Reserved_Keywords → int | float | string | read | write | repeat |  
until | if | elseif | else | then | return | endl
```

4) Comment Statement

```
Comment_Statement → COMMENT_START Char_Sequence COMMENT_END
```

5) Identifiers

```
Identifier → LETTER Identifier_Tail  
Identifier_Tail → LETTER Identifier_Tail | DIGIT Identifier_Tail | ε
```

6) Function Call

```
Function_Call → Identifier LEFT_PAREN Argument_List RIGHT_PAREN  
Argument_List → Expression Argument_Tail | ε  
Argument_Tail → COMMA Expression Argument_Tail | ε
```

7) Term

```
Term → Number | Identifier | Function_Call
```

8) Arithmetic Operator

```
Arithmetict_Operator → + | - | * | /
```

9)Equation

```
Equation → Term Equation_Tail | LEFT_PAREN Equation RIGHT_PAREN  
Equation_Tail  
Equation_Tail → Arithmetic_Operator Term Equation_Tail  
                  | Arithmetic_Operator LEFT_PAREN Equation RIGHT_PAREN  
Equation_Tail  
                  | ε
```

10) Expression

```
Expression → String | Term | Equation
```

11) Assignment Statement

```
Assignment_Statement → Identifier ASSIGN_OP Expression
```

12) Datatype

```
Datatype → int | float | string
```

13) Declaration Statement

```
Declaration_Statement → Datatype Identifier_List SEMICOLON  
Identifier_List → Identifier_Item Identifier_List_Tail  
Identifier_List_Tail → COMMA Identifier_Item Identifier_List_Tail | ε  
Identifier_Item → Identifier Assignment_Opt  
Assignment_Opt → ASSIGN_OP Expression | ε
```

14) Write Statement

```
Write_Statement → write Write_Content SEMICOLON  
Write_Content → Expression | endl
```

15) Read Statement

Read_Statement → read Identifier SEMICOLON

2.16 Return Statement

Return_Statement → return Expression SEMICOLON

17) Condition Operator

Condition_Operator → < | > | = | <>

18) Condition

Condition → Identifier Condition_Operator Term

19) Boolean Operator

Boolean_Operator → && | ||

20) Condition Statement

Condition_Statement → Condition Condition_Tail
Condition_Tail → Boolean_Operator Condition Condition_Tail | ε

21) If Statement

If_Statement → if Condition_Statement then Statements If_Tail end
If_Tail → Else_If_Statement | Else_Statement | ε

22) Else If Statement

Else_If_Statement → elseif Condition_Statement then Statements If_Tail

23) Else Statement

Else_Statement → else Statements

2.24 Repeat Statement

Repeat_Statement → repeat Statements until Condition_Statement

25) Function Name

FunctionName → Identifier

26) Parameter

Parameter → Datatype Identifier

27) Function Declaration

Function_Declaration → Datatype FunctionName LEFT_PAREN Parameter_List
RIGHT_PAREN

Parameter_List → Parameter Parameter_Tail | ϵ

Parameter_Tail → COMMA Parameter Parameter_Tail | ϵ

28) Function Body

Function_Body → LEFT_BRACE Statements Return_Opt RIGHT_BRACE

Return_Opt → Return_Statement | ϵ

29) Function Statement

Function_Statement → Function_Declaration Function_Body

30) Main Function

Main_Function → Datatype main LEFT_PAREN RIGHT_PAREN Function_Body

31) Program

Program → Function_List Main_Function
Function_List → Function_Statement Function_List | ε