

The Tiny Language

Note: (Task (1) deliverable: you will deliver a document containing the RE rules of Tiny Language + DFA + Scanner)

A program in TINY consists of a set of functions (any number of functions and ends with a main function), each function is a sequence of statements including (declaration, assignment, write, read, if, repeat, function, comment, ...) each statement consists of (number, string, identifier, expression, condition, ...).

Language described as:

- 1) **Number:** any sequence of digits and maybe floats (e.g. 123 | 554 | 205 | 0.23 | ...)
- 2) **String:** starts with double quotes followed by any combination of characters and digits then ends with double quotes (e.g. "Hello" | "2nd + 3rd" | ...)
- 3) **Reserved_Keywords:** int | float | string | read | write | repeat | until | if | elseif | else | then | return | endl
- 4) **Comment_Statement:** starts with /* followed by any combination of characters and digits then ends with */ (e.g. /*this is a comment*/ | ...)
- 5) **Identifiers:** starts with letter then any combination of letters and digits. (e.g. x | val | counter1 | str1 | s2 | ...)
- 6) **Function_Call:** starts with Identifier then left bracket "(" followed by zero or more Identifier separated by "," and ends with right bracket ")". (e.g. sum(a,b) | factorial(c) | rand() | ...)
- 7) **Term:** maybe Number or Identifier or function call. (e.g. 441 | var1 | sum(a,b) | ...)
- 8) **Arithmetic_Operator:** any arithmetic operation (+ | - | * | /)

- 9) **Equation:** starts with Term or left bracket "(" followed by one or more Arithmetic_Operator and Term. with right bracket ")" for each left bracket (e.g. $3+5$ | $x+1$ | $(2+3)*10$ | ...)
- 10) **Expression:** may be a String, Term or Equation (e.g. "hi" | counter | 404 | $2+3$ | ...)
- 11) **Assignment_Statement:** starts with Identifier then assignment operator "==" followed by Expression (e.g. $x := 1$ | $y := 2+3$ | $z := 2+3*2+(2-3)/1$ | ...)
- 12) **Datatype:** set of reserved keywords (int, float, string)
- 13) **Declaration_Statement:** starts with Datatype then one or more identifiers (assignment statement might exist) separated by coma and ends with semi-colon. (e.g. `int x;` | `float x1,x2:=1,xy:=3;` | ...)
- 14) **Write_Statement:** starts with reserved keyword "write" followed by an Expression or endl and ends with semi-colon (e.g. `write x;` | `write 5;` | `write 3+5;` | `write "Hello World";` | ...)
- 15) **Read_Statement:** starts with reserved keyword "read" followed by an Identifier and ends with semi-colon (e.g. `read x;` | ...)
- 16) **Return_Statement:** starts with reserved keyword "return" followed by Expression then ends with semi-colon (e.g. `return a+b;` | `return 5;` | `return "Hi";` | ...)
- 17) **Condition_Operator:** (less than "<" | greater than ">" | is equal "=" | not equal "<>")
- 18) **Condition:** starts with Identifier then Condition_Operator then Term (e.g. $z1 <> 10$)
- 19) **Boolean_Operator:** AND operator "&&" and OR operator "||"
- 20) **Condition_Statement:** starts with Condition followed by zero or more Boolean_Operator and Condition (e.g. $x < 5 \&\& x > 1$)

- 21) **If_Statement**: starts with reserved keyword “if” followed by Condition_Statement then reserved keyword “then” followed by set of Statements (i.e. any type of statement: write, read, assignment, declaration, ...) then Else_If_Statment or Else_Statment or reserved keyword “end”
- 22) **Else_If_Statement**: same as if statement but starts with reserved keyword “elseif”
- 23) **Else_Statement**: starts with reserved keyword “else” followed by a set of Statements then ends with reserved keyword “end”
- 24) **Repeat_Statement**: starts with reserved keyword “repeat” followed by a set of Statements then reserved keyword “until” followed by Condition_Statement
- 25) **FunctionName**: same as Identifier
- 26) **Parameter**: starts with Datatype followed by Identifier (e.g. int x)
- 27) **Function_Declaration**: starts with Datatype followed by FunctionName followed by “(“ then zero or more Parameter separated by “,” then “)” (e.g. int sum(int a, int b) | ...)
- 28) **Function_Body**: starts with curly bracket “{” then a set of Statements followed by Return_Statement and ends with “}”
- 29) **Function_Statement**: starts with Function_Declaration followed by Function_Body
- 30) **Main_Function**: starts with Datatype followed by reserved keyword “main” then “()” followed by Function_Body
- 31) **Program**: has zero or more Function_Statement followed by Main_Function

Code Sample

/*Sample program includes all 30 rules*/

```
int sum(int a, int b)
{
    return a + b;
}
int main()
{
    int val, counter;
    read val;
    counter:=0;
    repeat
        val := val - 1;
        write "Iteration number [";
        write counter;
        write "] the value of x = ";
        write val;
        write endl;
        counter := counter+1;
    until val = 1
    write endl;
    string s := "number of Iterations = ";
    write s;
    counter:=counter-1;
    write counter;
    /* complicated equation */
    float z1 := 3*2*(2+1)/2-5.3;
    z1 := z1 + sum(1,y);
    if z1 > 5 || z1 < counter && z1 = 1 then
        write z1;
    elseif z1 < 5 then
        z1 := 5;
    else
```

```
        z1 := counter;
    end
    return 0;
}
```

Code Sample

```
/* Sample program in Tiny language –
computes factorial*/
int main()
{
    int x;
    read x; /*input an integer*/
    if x > 0 then /*don't compute if x <= 0 */
        int fact := 1;
        repeat
            fact := fact * x;
            x := x - 1;
        until x = 0
        write fact; /*output factorial of x*/
    end
    return 0;
}
```