CS F351 Theory of Computation
Assignment-2
Simulation of basic C

Due date: 12 Dec 2022 11:59 PM   **Marks : 20**

Consider a programming language, basic C, which supports integer constants, variables, expressions, assignments, for loops, and read and write statements:

1. A *program* consists of a sequence of statements separated by semi-colons.

2. A *statement* is either a declaration-statement, read-statement, write-statement, declaration-statement, assignment-statement, or a for-loop.

3. A declaration-statement is of the form $int\ V_1, V_2, \ldots, V_k$; where $V_1, V_2, \ldots, V_k$ are variables of integer type. This statement must be the first statement in the program if it is presented and not allowed in any other part of the program. Further, no variable which is not listed here cannot be used in the rest of the program.

4. A read-statement is of the form $read\ X$ where X is a variable.

5. A write-statement is of the form $write\ Y$, where Y is either a variable or an integer constant.

6. An assignment statement is a statement of the form $V = E$ where V is a variable and E is an expression.

7. Expressions are obtained by applying binary operations $+, -, *, /, >, ==$ over variables and constants. Note that $*, /$ have higher precedence than $+, -$ and $+, -$ have higher precedence than $>, ==$. All binary operators associate from left to right. Further, expressions can also be parenthesized using $(,)$.

8. A for-loop is a statement of the form $for(E_1; E_2; E_3)\{S\}$; where E_1, E_2, E_3 are the expressions and S is a sequence of statements separated by semi-colons. Note that for-loop is the same as in C language except all statements must be written between $\{$ and $\}$ even if S is a single statement and there is a semi-colon (;) after $\}$.

9. Variable names are from $\{a-z\}^+$ but not from the set of keywords $\{for, int, read, write\}$.

10. In addition to the variables, the language also has support for *integer constants* of the form $\{0-9\}^+$.

1 Questions

1. Write an unambiguous grammar G for basic C with the above features.

2. Write a C program that outputs the syntax tree for the given program P in basic C. Further, your C program must simulate program P on the input given by the user (if any) at the run-time and print P's output.

2 Input and Output formats:

1. The input program P will be given in a text file, input.txt. If the program P reads any variables during the run time, the values will be provided from the console/terminal. Do not print any statements like "Enter the value of ....".

2. The output of the program P must be printed on the console/terminal.

3. The format of the syntax tree will be updated soon.

3   Instructions

1. Do the assignment in groups of size 4 or 5.

2. There will be a demo of your submission on 13 Dec 2022 from 5 PM to 9 PM. So, ensure all the group members are available during the evaluation.

3. Each group will be given a slot of 15-20 mins to explain the code and show the demo for different test cases.

4   Submission guidelines:

You must submit a single zip folder that contains:

- A pdf document with the unambiguous grammar for basic C and name it with your bits id. Further, mention the details of the group members.

- C program, named with main.c.

All the best.