# **Programming 2020 Minimal BASIC Interpreter**

Due: To be announced 207/.1.6

### Introduction

In this assignment, your mission is to build a minimal BASIC interpreter. You may start with the code TA provided.

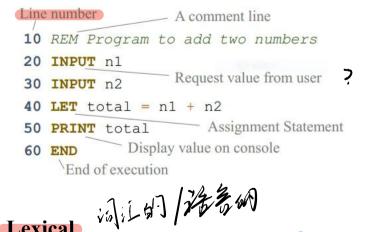
# **BASIC** Language and Interpreter

The programming language BASIC - the name is an acronym for Beginner's All-purpose Symbolic Instruction Code - was developed in the mid-1960s at Dartmouth College by John Kemeny and Thomas Kurtz.

A Plus B

In BASIC, a program consists of a sequence of numbered statements, as illustrated by the simple program below:

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Lexical

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Identifiers are formed by one or more letters. Keywords that are reserved words in the language cannot be used as identifiers. Integer literals are composed of digits only. In this lab, the language is 级 case-sensitive, which means i and I are different variables, and IF, if, If, and even iF have different

meanings.

### **Line Numbers**

The line numbers at the beginning of the line establish the sequence of operations in a program. In the absence of any control statements to the contrary, the statements in a program are executed in ascending numerical order starting at the lowest number.

Line numbers are also used to provide a simple editing mechanism. Statements need not be entered in order, because the line numbers indicate their relative position. Moreover, as long as the user has left gaps in the number sequence, new statements can be added in between other statements For example, to change the program that adds two numbers into one that adds three numbers, you would need to make the following changes:

Add a new line, inserted into the program between line 30 and line 40

40 LET total = n1 + n2 + n3

Replace the old line 40

The standard mechanism of deleting lines was to type in a line number with nothing after it on the line. Note that this operation actually deleted the line and did not simply replace it with a blank line that would appear in program listings.

# **Sequential Statements**

| REM /   | This statement is used for comments.  |  |
|---|---|--|
| LET var € exp   | This statement is BASIC's assignment statement.                                 |  |
| PRINT exp This statement print the value of the expression on the console and the   |   |  |
| print a newline character.  |   |  |
| INPUT var   | NPUT var This statement print a prompt consisting of the string "?" and then to |  |
| ٩   | read in a value to be stored in the variable.                                   |  |
| <b>END</b> Marks the end of the program. Execution halts when this line is reached. |   |  |
|   | Execution also stops if the program continues past the last numbered            |  |
|   | line  |  |

### **Control Statements**

For example, the following BASIC program simulates a countdown from 10 to 0:

Statement

```
10 REM Program to simulate a countdown
20 LET T = 10 Jumps to line 70 if the
30 IF T < 0 THEN 70 result of comparison is true
40 PRINT T
50 LET T = T - 1
60 GOTO 30
70 END Jumps to line 30 unconditionally
```

| GOTO n                 | This statement transfers control unconditionally to line n in the      |
|------------------------|--|
|                        | program. If line n does not exist, your BASIC interpreter should       |
| $\sim$                 | generate an error message informing the user of that fact.             |
| IIF exp cmp exp THEN n | This statement performs a conditional transfer of control On           |
|                        | encountering such a statement, the BASIC interpreter begins by         |
|                        | evaluating condition, which in the minimal version of BASIC            |
| (S)                    | consists of two arithmetic expressions oined by one of the             |
|                        | operators <, >, or =. If the result of the comparison is true, control |
|                        | passes to line n, just as in the GOTO statement; if not, the           |
|                        | program continues with the next line in sequence.                      |

# **Expressions**



### Expressions are used in LET, PRINT, and IF statements.

| int_const           | The simplest expressions are variables and integer constants.   |
|---------------------|---|
| var                 | O+5   |
| (exp)<br>exp op exp | These may be combined into larger expressions by enclosing an expression  |
| Executed            | in parentheses or by joining two expressions with the operators +, -, *, and /, just as in the interpreter presented in the reader. |
| Directly            | J   |

The LET, PRINT, and INPUT statements can be executed directly by typing them without a line number, in which case they are evaluated immediately. Thus, if you type in "PRINT 2 + 2" your program should respond immediately with 4.

The statements GOTO, IF, REM, and END are legal only if they appear as part of a program, which means that they must be given a line number.

# **BASIC Interpreter**

These commands control the BASIC interpreter, which don't comained in BASIC program.

| RUN  | This command starts program execution beginning at the lowest-numbered line |  |
|------|---|--|
| LIST | This command lists the steps in the program in numerical sequence.          |  |
|      |   |  |



| CLEAR | This command deletes all program and variables.                          |  |
|-------|--|--|
| QUIT  | This command exits from the BASIC interpreter by calling exit(0).        |  |
| HELP  | This command provides a simple help message describing your interpreter. |  |

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# **Error Reporting**

|                      | İ ,   |
|----------------------|---|
| DIVIDE BY ZERO       | Calculating some number divide by zero.           |
| INVALID NUMBER       | User types wrong value to answer INPUT statement. |
| VARIABLE NOT DEFINED | A variable used before assigned it.               |
| LINE NUMBER ERROR    | GOTO statement's line number not exist.           |
| SYNTAX ERROR         | Any other errors.                                 |

### **Evaluation**

Your score will be computed out of a maximum of 10 points based on the following rules:

Correctness: 100 trace files at 0.1 point each.

Style points: We expect you to have good comments, good OOP design and good code style. If your code smells terrible. You will lose up to 1.0 point.

Your solution will be tested for correctness on a Linux machine, using the same score program and trace files that were included in your lab directory. Your interpreter should produce identical output on these traces as the demo.

Cheaters will receive 0 point.

# The score program

Your implementation will be evaluated using score in Test folder. You can evaluate your implementation by yourself. Try "./score -f -c" to evaluate your program. Type "./score -h" for more details about our score program.

Note: The score program is only available under Linux/Mac OS X (not fully supported). Although start code, demo and traces are provided for all OSes, we highly recommended you to complete the Lab under Linux.

### Hand-in

Your code must be written in C++. And, you are not allowed to use compiler-compiler or any other tools to generate your codes. You should work in Basic folder. You may add or modify files in this folder. For Linux user, keep your Makefile can produce executable file named Basic correctly when we type make in this folder.

You should zip the Basic folder only and upload onto the website. You should not include any executable files.