Programming Assignment #3

Binary Decision Diagram (BDD)

Objective

1. To exercise the concept of binary decision diagram.
2. Utilize the binary decision diagram to the circuit design application.

Please implement a power estimator, which can calculate the signal probability of output function, $f = 1$, of the given Boolean equation in sum-of-product (SOP) form.

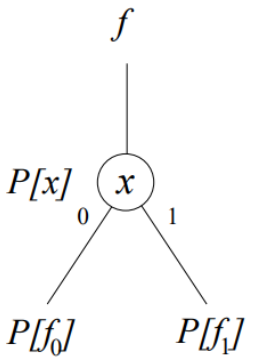
Input file includes one Boolean function and the corresponding probabilities of variables specified in the following format:

Input

Boolean equation.
Probability of variable_1
Probability of variable_2
..
Probability of variable_n

The first line describes the Boolean equation, while the following lines give the probability of each variable. The equation ends up with a period and every variable is represented by exactly one character (i.e., 26 variables at most). The Boolean equation is given in SOP form: lowercase character represents a plain variable, whereas its uppercase counterpart is for its complement.

Please construct a BDD with the Boolean function, and bottom-up determine probabilities of function *f* with equations shown below:



$$\begin{aligned}(1-P[x])(1-P[f_0])+P[x](1-P[f_1]) \quad & for\ f=0\\ (1-P[x])P[f_0]+P[x]P[f_1] \quad & for\ f=1\end{aligned}$$

Input example is shown below:

```
ABcD+ABCD+aBcD+aBCD.
A 0.7      // P(A) = 0.7: the probability of signal A, thus P(a) = 0.3
B 0.8      // P(B) = 0.8: the probability of signal B, thus P(b) = 0.2
C 0.5      // P(C) = 0.5: the probability of signal C, thus P(c) = 0.5
D 0.4      // P(D) = 0.4: the probability of signal D, thus P(d) = 0.6
```

Output

Output: probability of output function, $f = 1$

```
0.320
```

※Please round off to the third decimal place.

Compile & Execute

Note that input and output file should be the arguments of program. Please make sure your code can be compiled and executed. If it cannot be executed, you will get zero point!

Program Submission

1. Please use the C/C++ language, and write your own code.
2. The materials of CUDD package is provided, which is optionally used in your program.
3. Please upload the following materials in a "zip" file to New E3 by the deadline. Name the zip file as: -Student_ID.zip.
    1. Source code. Your source file must be named as "Student_ID_lab3.c", and please make sure that all characters in filename are in lower case. For example, if your student number is 9811592, your program file should be named as "9811592_lab3.c".
    2. Executable binary file (Lab3)

       Execution command: ./Lab3 [input] [output]

       e.g.: ./Lab3 input1 output1
    3. A readme file (Describe your compile and execution information)

Grading

- **Problem 1** **100%**
  - **Case1** **20%**
  - **Case2** **20%**
  - **Case3** **20%**
  - **Case4 (hidden)** **20%**
  - **Case5 (hidden)** **20%**

***** Time limit is 300s. Otherwise, the case is regarded as failed.

Notices

- **Due Date: 2021.5.24 23:55**
- **You'll get 0 grade if failing to hand in on time.**
- **Plagiarism is strictly forbidden. 0 grade guarantee!**