January 2023 CSE 208
Offline Assignment on SCC

Deadline: Saturday, 26^{th} August, 2023, 11:55 PM

The Satisfiability problem is to determine whether a given arbitrary Boolean formula is true for some TRUE/FALSE assignment to the variables. The problem is very hard in general, and we do not even hope to find an efficient solution to the problem.

However, in this assignment, you will have to solve this problem for a restricted type of input. Your Boolean formula will be in conjunctive normal form (also known as PRODUCTS OF SUMS). In addition, every SUM clause will consist of at most two literals. Each literal is either a variable or its complement. You will have to find any valid assignment of TRUE/FALSE to each variable so that the given formula is satisfied.

Input Format

In the first line, there will be an integer n, denoting the number of clauses. Each of the following n lines will describe a clause. Each clause will be either a literal or the SUM (logical OR) of two literals. If a literal is a variable, it will be represented by a lowercase English letter (a-z). If a literal is a complement of a variable, it will be represented by a tilde (`~`) followed by the lowercase letter corresponding to the variable.

Output Format

For each of the m variables, print the corresponding letter and the TRUE/FALSE assignment, if any such arrangement is possible. Otherwise, print `No assignment possible`.

Intended Time Complexity: $\mathcal{O}(n + m)$

Sample I/O

Input 1

```
5
a ~b
b ~c
~c d
d
a d
```

Output 1

```
a True
b False
c False
d True
```

Explanation

The given input represents `(a OR (NOT b)) AND (b OR (NOT c)) AND ((NOT c) OR d) AND (d) AND (a OR d)`. A satisfying assignment is shown.

Input 2

```
7
a ~b
b ~c
~c d
d
a d
c ~c
~d
```

Output 2

```
No assignment possible
```

Explanation

The given input represents `(a OR (NOT b)) AND (b OR (NOT c)) AND ((NOT c) OR d) AND (d) AND (a OR d) AND (c OR (NOT c)) AND (NOT d)`. No satisfying assignment is feasible.

Submission Guideline

1. Create a directory with your 7 digit student id as its name
2. Put the source files only into the directory created in step 1
3. Zip the directory (compress in .zip format; .rar, .7z or any other format is not acceptable)
4. Upload the .zip file on moodle.

For example, if your student id is 2105xxx, create a directory named 2105xxx. Put only your source files (.c, .cpp, .cc, .h, etc.) into 2105xxx. Compress 2105xxx into 2105xxx.zip and upload the 2105xxx.zip on MOODLE.

Hints

Try to form a graph from the given formula and construct SCCs.

For Queries

If you have any questions related to the assignment please first check the queries thread in MOODLE. You should post your confusion in the thread.

Special Instructions

When writing code, it is essential to ensure readability, reusability, and good structure. This involves using appropriate functions to implement algorithms, giving variables meaningful names, adding suitable comments when necessary, and maintaining proper indentation. You will need to use your offline implementation to solve the onlines. There will be a viva too. So, please understand the concepts before you proceed to code.

Please note that you must rely on your own implementation to solve the assigned tasks. It is strictly prohibited to copy code from any source, including friends, seniors, or the internet. **Any form of plagiarism, regardless of its origin or destination, will result in a deduction of 100% marks for the offline assessment**. Moreover, repeated instances of plagiarism may lead to stricter consequences in accordance with departmental policies.