Problem 7: +9QH
5 Points

Problem ID: `plus9qh`

Rank: `2`

Introduction

You are a small vocaloid producer just starting out in the music industry. With the help of the one-and-only virtual pop sensation Hatsune Miku herself, you release your debut single to show the world what you're made of. But when you come back from the grocery store to buy leeks for your Miku shrine, you return to find that Cliff L. Biffle has hacked into your Miku voicebank and now she only sings 99 Bottles of Beer on the Wall instead of your new song Hello, world! What on earth did Cliff L. Biffle do to Miku?!?!?!

Problem Statement

You're given N lines of text X_1, X_2, $...$, X_N. Find the *shortest* HQ9+ program that outputs exactly the given text, or determine that no such program exists.

An HQ9+ program is a string consisting of the following single-character instructions:

Instruction	Description
H	Output a single line containing `Hello, world!`
Q	Output a single line containing all of the instructions of the current program being executed (a quine).
9	Output the **first six lines** of 99 Bottles of Beer on the Wall (see sample input for examples).
+	Increment the accumulator, a variable that is never used. This instruction outputs nothing.

When an HQ9+ program is executed, instructions are executed from left to right.

Input Format

The first line of the input contains a single integer T denoting the number of test cases that follow. For each test case:

- The first line contains a single integer N denoting the number of lines of text.
- The next N lines each contain one line of text, X_1, X_2, ..., X_N.

Output Format

For each test case, output the *shortest* HQ9+ program that outputs exactly the given text. If there are multiple solutions, output any of them. If there are no solutions, output `IMPOSSIBLE`

Constraints

$1 \le T \le 10$
$1 \le N \le 1000$
$1 \le |X_i| \le 1000$ (Lines contain at most 1000 characters)

Lines will contain only [ASCII printable characters](#) and spaces.
Lines will not begin or end with space characters.
Lines will not be empty.

Sample Test Cases

```
6
1
Hello, world!
9
Hello, world!
H++QH9
Hello, world!
99 bottles of beer on the wall, 99 bottles of beer.
Take one down and pass it around, 98 bottles of beer on the wall.
98 bottles of beer on the wall, 98 bottles of beer.
Take one down and pass it around, 97 bottles of beer on the wall.
97 bottles of beer on the wall, 97 bottles of beer.
Take one down and pass it around, 96 bottles of beer on the wall.
7
69 bottles of beer on the wall, 69 bottles of beer.
Take one down and pass it around, 68 bottles of beer on the wall.
68 bottles of beer on the wall, 68 bottles of beer.
Take one down and pass it around, 67 bottles of beer on the wall.
67 bottles of beer on the wall, 67 bottles of beer.
Take one down and pass it around, 66 bottles of beer on the wall.
Hello, world!
10
We're no strangers to love.
You know the rules, and so do I.
A full commitment's what I'm thinking of.
You wouldn't get this from any other guy.
I just wanna tell you how I'm feeling.
Gotta make you understand.
9Q++QHH
9Q++QHH
Never gonna give you up, never gonna let you down.
Never gonna run around and desert you.
7
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
3
Hello, world!
HQ+Q
H+QQ
```

Sample Output

```
H
H++QH9
IMPOSSIBLE
IMPOSSIBLE
QQQQQQ
IMPOSSIBLE
```

Sample Explanations

Test Case #1:

The HQ9+ program with the single instruction `H` causes `Hello, world!` to be outputted, matching the text given. `H` is also the shortest program that outputs `Hello, world!`

Test Case #2:

The only HQ9+ program that produces this text is `H++QH9`. The program is executed as follows:

1. `H` outputs `Hello, world!`
2. `+` increments the accumulator, which has no effect on the output.
3. `+` increments the accumulator again, which has no effect on the output.
4. `Q` outputs the source code of the HQ9+ program, which is `H++QH9`
5. `H` outputs `Hello, world!` again.
6. `9` outputs the first six lines of *99 Bottles of Beer*.

Test Case #3:

The output is impossible because the numbers in the verses do not match what is expected.

Test Case #4:

https://www.youtube.com/watch?v=cvh0nX08nRw

Test Case #6:

The quines in the text suggest two conflicting sets of instructions, but a program can only have one set of instructions. Thus, there is no solution.

第 7 题: +9QH
5 分

问题标识符: `plus9qh`
难度等级: 2

问题背景

作为刚进入音乐行业的制作人，你在虚拟流行歌星初音未来的帮助下发布了你的首支单曲，向世界展示你的才华。但是，当你从"初音神社"杂货店购买周边归来时，却发现克里夫擅自侵入了初音的音源库。现在，你的初音女神只能唱《99 Bottles of Beer on the Wall》，而不是你的新歌《Hello world!》了。克里夫到底对初音女神做了什么？！

问题描述

给定 **N** 行文本 $X_1, X_2, ... , X_N$。请找出任意一个能够输出给定文本的 HQ9+ 程序，或者确定这样的程序不存在。

HQ9+ 程序是一个由以下单一字符指令组成的字符串:

指令	说明
H	输出一行文本 `Hello, world!`
Q	输出一行包含当前正在执行程序的所有指令 (一个*自产生* 程序)。
9	输出歌曲*99 Bottles of Beer on the Wall* 中前六行的内容（详细文本请参考样本输入）
+	增加" 累加器"，这是个不会被使用的变量。这条指令不输出任何内容。

执行HQ9+ 程序时，指令将从左至右依次执行

输入格式

输入的第一行包含一个整数 **T**，表示后面测试用例的数量。

对于每一个测试用例:

- 第一行仅包含一个整数 **N**，表示文本的行数。
- 后面的 **N** 行，每行包含一行文本 $X_1, X_2, ..., X_N$。

输出格式

对于每个测试用例，请输出长度最短的HQ9+程序，使其能够输出给定文本。如果存在多个这样的程序，则输出其中任意一个。如果不存在这样的程序，请输出 `IMPOSSIBLE`。

数据范围

$1 \le T \le 10$

$1 \le N \le 1000$

$1 \le |X_i| \le 1000$ (文本行最多包括 1000 个字符)

文本行只包括 [ASCII编码程序支持的字符](#)和空格。
文本行不能以空格开始或结尾。
文本行不能为空。

如果存在符合要求的程序，输出不能为空。

测试样例

样例输入 *Download*

```
6
1
Hello, world!
9
Hello, world!
H++QH9
Hello, world!
99 bottles of beer on the wall, 99 bottles of beer.
Take one down and pass it around, 98 bottles of beer on the wall.
98 bottles of beer on the wall, 98 bottles of beer.
Take one down and pass it around, 97 bottles of beer on the wall.
97 bottles of beer on the wall, 97 bottles of beer.
Take one down and pass it around, 96 bottles of beer on the wall.
7
69 bottles of beer on the wall, 69 bottles of beer.
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Take one down and pass it around, 67 bottles of beer on the wall.
67 bottles of beer on the wall, 67 bottles of beer.
Take one down and pass it around, 66 bottles of beer on the wall.
Hello, world!
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We're no strangers to love.
You know the rules, and so do I.
A full commitment's what I'm thinking of.
You wouldn't get this from any other guy.
I just wanna tell you how I'm feeling.
Gotta make you understand.
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Never gonna give you up, never gonna let you down.
Never gonna run around and desert you.
7
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
QQQQQQQ
3
Hello, world!
HQ+Q
H+QQ
```

样例输出

Download

```
H
H++QH9
IMPOSSIBLE
IMPOSSIBLE
QQQQQQQ
IMPOSSIBLE
```

样例说明

测试用例 #1:

HQ9+ 程序仅包含一个指令 H ,可以输出 Hello,world!,与要求相符。同时,程序也是能输出 Hello,world!的最短程序。

测试用例 #2:

唯一能输出该文本的 HQ9+ 程序为 H++QH9。该程序执行如下:

1. H 输出Hello, world!
2. + 增加累加器,对输出无影响。
3. + 再增加累加器,对输出无影响。
4. Q 输出HQ9+ 程序 H++QH9 的源代码,即 H++QH9。
5. H 再次输出 Hello, world! 。
6. 9 在后面的 6 行中输出 *99 Bottles of Beer* 的前三节。

测试用例 #3:

小节中的数字与歌词不符,没有程序能输出该小节,所以输出 IMPOSSIBLE。

测试用例 #4:

https://www.bilibili.com/video/BV1WK4y1Q7iS/?spm_id_from=333.337.search-card.all.click

测试用例 #6:

文本中的自产生程序显示了两组相互冲突的指令,但一个程序只能有一组指令。因此,没有符合要求的程序。