B Boggle Sort

Time limit: 1s

It is the 25th of February, 2025. You have enjoyed another spirited evening of *Boggle* with your friends. After everybody left, you have thoroughly cleaned the apartment. All that is left is to bring the Boggle tray in order. You start to wonder: would it be possible to bring the Boggle tray in alphabetic order, without swapping any dice, but only by rotating them?

A tray of Boggle dice, out of order. CC-BY-2.0 by Rich Brooks on Wikimedia Commons

The Boggle tray consists of 16 six-sided dice. Each die is labelled with a letter from the English alphabet on each face. A single die contains a face labelled "Qu". No letter appears 4 or more times on the same die. By turning a die once, you can move any of the sideways-facing letters up. Turning a die twice moves the downwards-facing letter up.

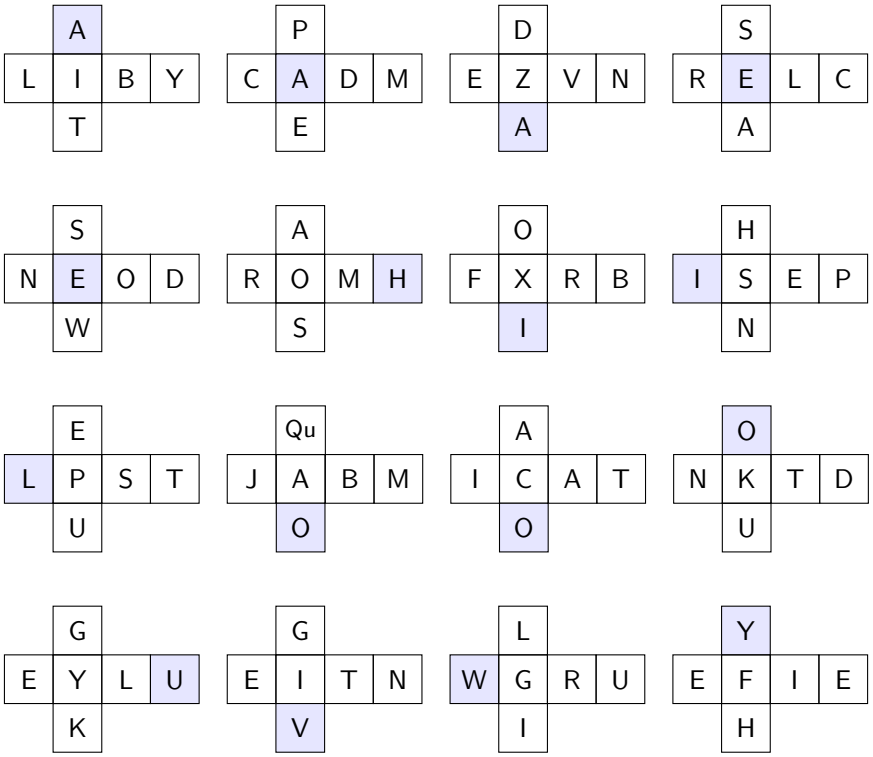

Figure B.1: Visualization of the first sample input. The 16 Boggle dice are shown in reading order. For each die, the face in the center of the cross ("I" in the first die) is upwards-facing and the face on the far right ("Y" in the first die) is downwards-facing. The shaded die faces describe an optimal solution requiring 15 turns.

Bring the tray into alphabetically nondecreasing order, using standard reading directions (left-to-right, top-to-bottom), using as few turns as possible. Letter case plays no role and the two-letter face is treated as "Q" followed by "U", so "QuU" is sorted but "QuT" is not.

Input

The input consists of:

- One line with 16 letters, describing the currently upwards-facing faces of each die.
- Four lines with 16 letters, describing the currently sideways-facing faces of each die.
- One line with 16 letters, describing the downwards-facing faces of each die.

In each line, the ith letter describes the ith die for $1 \leq i \leq 16$.
All letters are English uppercase letters (`A`–`Z`).
The letter "`Q`" stands for the two-letter face "Qu" and appears exactly once in the input.
No letter appears 4 or more times on the same die.

Output

If it is possible to bring the tops of the dice into alphabetic order, output the minimum number of turns needed to do so. Otherwise, output "`impossible`".

Sample Input 1	**Sample Output 1**
IAZEEOXSPACKYIGF APDSSAOHEQAOGGLY LCERNRFILJINEEWE BDVLOMRESBATLTRI TEAAWSINUOOUKVIH YMNCDHBPTMTDUNUE	15

Sample Input 2	**Sample Output 2**
EXFETDMNMGDBRSRM TIEGINOVRETACNUA PRYKASAEATNTSHID SOHUOEJDHVKYLPLC UFIYAWBZONUIEIWE LBELCOQASIOLAEGP	impossible