WORLD WAR PROJECT

You and your best friend Brian go to the same history class, and the teacher presents you with a study project regarding World War I. Since it is a favorite topic for both of you, you extensively research it. But Brian is concerned somebody might steal your research and make their own. You decide to encrypt any conversations you have through emails regarding the project.

While researching for the project, you learn that Germans introduced the “Secret Cipher of the Radio Operators 1918,” also known as **ADFGX cipher** invented by German’s signal corps officer Lieutenant Fritz Nebel. You decide to stay with the theme and adopt this cipher for encrypting the messages you send to each other.

Given a key square(Polybius square), keyword, and the plaintext message, encrypt the message using the ADFGX cipher and return the cipher text.

About the algorithm:

This algorithm is a product cipher of two ciphers: Polybius square cipher and columnar transposition. The encrypting takes place in two phases. The first phase is performing substitution, while the second phase is fractionating.

1. During the substitution phase, we substitute each letter with two letters retrieved from the polybius square.
2. After this, fill the enciphered text below the keyword in a matrix format, left to right in a row and top to bottom. Now perform columnar transposition by sorting the keyword in alphabetical order.
3. Now retrieve the text from the matrix column-wise top to down to get the final ciphered text

Input Format

The input consist of 3 lines where:

1. The first line consists of the keyword for columnnar transposition
2. The second line consists of a permutation of the alphabet except for the letter J. This should be used to fill the polybius square in left to right fashion
3. The third line consists of the plain text to encrypt

Constraints

1. Input string will consist of only A-Z characters i.e.., english alphabets in upper case only.
2. You are not allowed you use libraries like cryptography available in python.

Output Format

Cipher text - string

Sample Input 0

```
GERMAN
PHQGMEAYNOFDXKRCVSZWBUTIL
ATTACK
```

Sample Output 0

```
XFDDDDFAFGXG
```

Explanation 0

See the following website for a detailed explanation ADFGX Cipher example