Enigma Machine

This challenge is to simulate the three rotor M3 Enigma Machine. For each test three lines of information will be provided; the first line will contain the rotor settings, the second the plugboard, and the third will be the text to encode/decode with the Enigma cipher.

Input

The first line will contain a single value T, for the number of tests to follow, where T <= 100.

For each test there will be three lines:

- The first line will contain three entries indiciating: the *Walzenlage,* the *Ringstellung,* and the *Grundstellung* in the form '123 AAA BBB'. The *Walzenlage* only contains numbers 1-5. The *Ringstellung* and *Grundstellung* will be provided as triplets of letters in the range A-Z.
- The second line will contain pairs of letters, from the range A-Z, indicating the settings for the *Steckerbrett* - there may be up to 13 pairs of letters.
- The final line of the test will contain an unknown length message to encode/decode - the message will be in the standard quintuple form used at the time, separated with spaces, eg 'ABCDE FGHIJ KL'. The final group may be 1-5 letters in length. Again, only the range of letters A-Z will be used. The line will be terminated in a newline ('0x0A').

The Enigma machine used is the three rotor M3 version. This had five rotors, of which only three would have been installed at any time. The *Umkehrwalze* in use is the 'B' wiring.

Output

The output is to match the third line of the input, i.e. must be in the same quintuple grouping. One line of output per message is to be produced.

Example

Input:

```
2
123 JAN DER
SP OJ RU LZ
THISX ISXAN XEXAM PLEXI NPUT
543 SPO JPL
SH OR TE NI
YUQKD YVPSF HCQEI VHAPE NAQZQ I
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Output:

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SJLKM SVZYM HXTUW VVWYY EDEB
THISX ISXAX DECOD XEDXM ESSAG E
```