Every person's blood has 2 markers called ABO alleles. Each of the markers is represented by one of three letters: A, B, or O. This gives six possible combinations of these alleles that a person can have, each of them resulting in a particular final blood type for that person.

|  |  |
| --- | --- |
| Marker 1 Marker 2 | Final Blood Type |
| A A | A |
| A O | A |
| A B | AB |
| B B | B |
| B O | B |
| O O | O |

Likewise, every person has two alleles for the blood Rh factor (called Rh allele 1 and Rh allele 2), represented by the characters + and -. Based on the combination of Rh allele 1 and Rh allele 2, the individual will have a Resultant Rh factor. So for an individual:

|  |  |  |
| --- | --- | --- |
| Rh allele 1 | Rh allelle 2 | Resultant Rh factor |
| + | + | + |
| + | - | + |
| - | + | + |
| - | - | - |

The blood type of a person is a combination of final blood type and Rh factor. The blood type is written by suffixing the blood type with the + or - representing the Rh factor. Examples include A+, AB- , and O-.

Blood types are inherited: each biological parent donates one allele (randomly chosen from their two) and one Rh factor allele to their child. Therefore 2 alleles and 2 Rh factor alleles of the parents determine the child's blood type. For example, the father’s blood type is  A-, and the mother’s blood type is B-, then the child could have either type A-, B-, AB- or type O- blood. How does that work?

Father: A-, so possible combinations for Marker 1 and Marker 2: {A,A} and{ A,O}. Similarly Rh – means the Rh allele 1, Rh allele 2 can only be {-,-}.

Mother: B-, so possible combinations: {B,B} and {B,O}, Rh: {-,-}

So now the child can inherit one marker from his father and one from his mother:

So the child’s possible ABO combinations:

|  |  |  |
| --- | --- | --- |
| From Father | From Mother | Child |
| A | B | AB |
| A | O | A |
| O | B | B |
| O | O | O |

For Rh, since both his parents have both Rh alleles as -, the child can only have 2 ‘-‘ Rh alleles. So that means that the resultant Rh allele for the child is also ‘-‘.

Putting together the ABO and Rh allele, the child can have blood type:

A-, B-, AB-, O-.

Let’s take the reverse problem, given a parent and child’s blood group – list the possible ABO combinations for the other parent.

A+ ? O-

In this case for the parent, possible combinations for Marker 1 and Marker 2:

|  |  |  |
| --- | --- | --- |
| A | A | A |
| A | O | A |

Rh possibilities: {+,-} and {+,+}.

Now, the only way the child can get O blood group is if he/she gets an O from one parent and a O from another parent. So parent 2 must be {A,O}, {B,O} or {O,O} – which results in A,B, O type for parent 2.

Similarly for the Rh, since the child has a – Rh, that’s only possible if he/she inherits two ‘–‘ Rh alleles. Since parent 1 can supply one ‘-‘, parent 2 also has to supply one ‘-‘. Parent 1 has + which means that he/she can supply a ‘-‘, since {+,-} results in a ‘+‘. So parent 2 can have both ‘+’ and ‘–‘ since then there is a valid combination where parent 2 also can supply a ‘-‘ : ( {+,-}, {-,-} ).

So in this case, the other parent should be either of A+, A-, B+, B-, O+,O-.

In the problem, you will be given the blood type of either both parents or one parent and a child; you will then determine the (possibly empty) set of blood types that might characterize the child or the other parent.

Note: an uppercase letter ``Oh" is used in this problem to denote blood types, not a digit (zero).

Your program should be written in the following way:

C: **bloodgroup.c** . The executable generated after compilation of this file will be run as follows:

**./a.out < input.file > output.file**

Java: Your main class should be **BloodGroup.java** in the package **bg**. After compilation this will be executed as follows:

**java –classpath . bg.BloodGroup < input.file > output.file**

**Input**

The input consists of multiple test cases. The first line will provide the number of test cases. Each test case is on a single line in the format: the blood type of one parent, the blood type of the other parent, and finally the blood type of the child, except that the blood type of one parent or the child will be replaced by a question mark. To improve readability, whitespace may be included anywhere on the line except inside a single blood type specification. Blank lines, if any should be ignored. The sample input for the examples given above:

2

A-  B- ?

A+ ? O-

**Output**

For each test case in the input, print the missing blood types. If no blood type for a parent is possible, print Z. If multiple blood types for parents or child are possible, print all possible values separated by a whitespace. For more than one values they should follow the same order as given in the first table i.e. if A-, O- and AB+ is the result it should be printed as A- AB+ O- . Within the same ABO type, ‘+’ should precede ‘-‘, i.e. if the answer is A+ and A-, it should be A+ A-

Output for the sample input

1. AB- B- O-

A+ A- B+ B- O+ O-