Last Hour Resolver

What is the most exciting part of an ICPC event? It is definitely the Last Hour Resolver! During the awarding ceremony, people focus on the screen to watch the scoreboard being unfrozen. Everyone holds their breath, waiting for the result, and screams loudly every time a team successfully solves a problem!

Note:

- *This problem is inspired by the format of ICPC. However, it has been modified and simplified to be suitable for an algorithmic problem. Therefore, the rules stated in this problem are different from the official rules of ICPC.*
- *No knowledge of the official ICPC rules is necessary or advantageous for solving this problem.*
- *You should solve this problem solely based on what is stated explicitly in the problem statement.*

This year, the ICPC Vietnam National Programming Contest attracts n teams, which are numbered from 1 to n. The problemset consists of m problems, which are labeled using the first m uppercase English letters: Problem 1 is labeled as `A`, problem 2 is labeled as `B`, and so on.

An ICPC contest lasts for 5 hours. During the first 4 hours, the scoreboard is available and all contestants can see the results of their opponents. However, the scoreboard is frozen during the last hour, preventing a team from knowing the results of all other teams.

Teams' results are measured by the number of problems solved as well as a value called *penalty*. When a team successfully solves a problem, their *penalty* is increased by a value, which is determined by the moment they make the first correct submission for this problem, and the number of incorrect submissions before this submission. Note that unsolved problems do not affect a team's *penalty*.

Teams are ranked from 1 to n using the following rules:

- Teams with more solved problems are ranked higher.
- Among teams with the same number of solved problems, teams with smaller penalty are ranked higher.
- Among teams with the same number of solved problems and the same penalty, teams with smaller indices are ranked higher.

It can be seen that no two teams can have the same rank.

The frozen scoreboard is an $n \times m$ matrix, where the cell at the i-th row and the j-th column represents the status of the i-th team on the j-th problem, which can be in any of the following forms:

- `+` p: The team solved this problem before the last hour, and their penalty is increased by p.
- `-`: The team did not solve this problem before the last hour, and did not make submissions during the last hour.
- `?` p: The team did not solve this problem before the last hour, and they made

submissions during the last hour. The result is still unknown publicly, and there can be two possible scenarios:

- The cell becomes `+` p: At least one submission is correct. The team gets one more solved problem and their penalty is increased by p.
- The cell becomes `-`: All submissions are incorrect. The team does not get one more solved problem and their penalty stays the same.

The contest has ended and now the most amazing part begins: Last Hour Resolver! Unfortunately, the resolver program contains a bug: Instead of showing the exact verdicts of submissions during the last hour, the resolver resolves randomly! In particular, every cell in the form `?` p turns into either `+` p or `-` with equal probability. Obviously, this makes the scoreboard extremely hard to predict!

Since the result is quite random, all the teams would like to know their expected ranking. As they are too tired after 5 hours of coding, they ask for your help. Given the frozen scoreboard, your task is to calculate the expected ranking of all the teams.

Input

The first line contains two integers n and m ($1 \le n \le 2000; 1 \le m \le 13$) – the number of teams and problems, respectively.

In the next n lines, the i-th one contains m strings $s_{i,1}$, $s_{i,2}$, ..., $s_{i,m}$; where $s_{i,j}$ denotes the status of the i-th team on the j-th problem, which is in any of the following forms: "`+` p", "`-`" or "`?` p". p is an integer in range $[1; 2 \cdot 10^4]$.

Output

Print n lines, the i-th one contains an irreducible fraction of the form x/y representing the expected ranking of the i-th team. The fraction x/y is irreducible if x and y are coprime, and $y > 0$. It can be proven that the expected ranking is always a rational number.

Sample Input 1	Sample Output 1
3 3 + 2 + 3 ? 4 - ? 1 + 3 ? 2 - -	5/4 2/1 11/4

Sample Input 2	Sample Output 2
3 1 ? 1 ? 1 ? 1	3/2 2/1 5/2

Sample Explanation

The following image demonstrates the frozen scoreboard in the first sample:

	Solved	Penalty	A	B	C
Team 1	2	5	+2	+3	? 4
Team 2	1	3	-	? 1	+3
Team 3	0	0	? 2	-	-

There are 3 cells of the form "? p", meaning that there are $2^3 = 8$ possible scenarios, with equal probability:

	Solved	Penalty	A	B	C
Team 1	3	9	+2	+3	+4
Team 2	2	4	-	+1	+3
Team 3	1	2	+2	-	-

	Solved	Penalty	A	B	C
Team 1	3	9	+2	+3	+4
Team 2	2	4	-	+1	+3
Team 3	0	0	-	-	-

	Solved	Penalty	A	B	C
Team 1	3	9	+2	+3	+4
Team 3	1	2	+2	-	-
Team 2	1	3	-	-	+3

	Solved	Penalty	A	B	C
Team 1	3	9	+2	+3	+4
Team 2	1	3	-	-	+3
Team 3	0	0	-	-	-

	Solved	Penalty	A	B	C
Team 2	2	4	-	+1	+3
Team 1	2	5	+2	+3	-
Team 3	1	2	+2	-	-

	Solved	Penalty	A	B	C
Team 2	2	4	-	+1	+3
Team 1	2	5	+2	+3	-
Team 3	0	0	-	-	-

	Solved	Penalty	A	B	C
Team 1	2	5	+2	+3	-
Team 3	1	2	+2	-	-
Team 2	1	3	-	-	+3

	Solved	Penalty	A	B	C
Team 1	2	5	+2	+3	-
Team 2	1	3	-	-	+3
Team 3	0	0	-	-	-

- Team 1 has probability $\frac{6}{8}$ of being ranked 1 and probability $\frac{2}{8}$ of being ranked 2. Their expected ranking is $\frac{6}{8} \times 1 + \frac{2}{8} \times 2 = \frac{5}{4}$.
- Team 2 has probability $\frac{2}{8}$ of being ranked 1, probability $\frac{4}{8}$ of being ranked 2, and probability $\frac{2}{8}$ of being ranked 3. Their expected ranking is $\frac{2}{8} \times 1 + \frac{4}{8} \times 2 + \frac{2}{8} \times 3 = 2$.
- Team 3 has probability $\frac{2}{8}$ of being ranked 2 and probability $\frac{6}{8}$ of being ranked 3. Their expected ranking is $\frac{2}{8} \times 2 + \frac{6}{8} \times 3 = \frac{11}{4}$.

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