

Round 1B 2011

A. RPI[B. Revenge of the Hot Dogs](#)[C. House of Kittens](#)[Contest Analysis](#)[Questions asked](#) **1**

Submissions

RPI

8pt Not attempted
4532/4664 users
correct (97%)12pt Not attempted
4408/4524 users
correct (97%)

Revenge of the Hot Dogs

15pt Not attempted
1244/2455 users
correct (51%)20pt Not attempted
595/1216 users
correct (49%)

House of Kittens

20pt Not attempted
320/640 users
correct (50%)25pt Not attempted
51/123 users
correct (41%)

Top Scores

rng..58	100
ZhukovDmitry	100
winger	100
RAVEman	100
malcin	100
Gennady.Korotkevich	100
ivan.popelyshev	100
ilyakor	100
vepifanov	100
yeputons	100

Problem A. RPI

This contest is open for practice. You can try every problem as many times as you like, though we won't keep track of which problems you solve. Read the [Quick-Start Guide](#) to get started.

Small input
8 points

Solve A-small

Large input
12 points

Solve A-large

Problem

In the United States, 350 schools compete every year for an invitation to the NCAA College Basketball Tournament. With so many schools, how do you decide who should be invited? Most teams never play each other, and some teams have a much more difficult schedule than others.

Here is an example schedule for 4 teams named A, B, C, D:

```

|ABCD
-+---
A|.11.
B|0.00
C|01.1
D|.10.

```

Each 1 in a team's row represents a win, and each 0 represents a loss. So team C has wins against B and D, and a loss against A. Team A has wins against B and C, but has not played D.

The NCAA tournament committee uses a formula called the RPI (Ratings Percentage Index) to help rank teams. Traditionally, it has been defined as follows:

$$RPI = 0.25 * WP + 0.50 * OWP + 0.25 * OOWP$$

WP, OWP, and OOWP are defined for each team as follows:

- WP (Winning Percentage) is the fraction of your games that you have won.
In the example schedule, team A has WP = 1, team B has WP = 0, team C has WP = 2/3, and team D has WP = 0.5.
- OWP (Opponents' Winning Percentage) is the average WP of all your opponents, after first throwing out the games they played against you.
For example, if you throw out games played against team D, then team B has WP = 0 and team C has WP = 0.5. Therefore team D has OWP = 0.5 * (0 + 0.5) = 0.25. Similarly, team A has OWP = 0.5, team B has OWP = 0.5, and team C has OWP = 2/3.
- OOWP (Opponents' Opponents' Winning Percentage) is the average OWP of all your opponents. OWP is exactly the number computed in the previous step.
For example, team A has OOWP = 0.5 * (0.5 + 2/3) = 7/12.

Putting it all together, we see team A has $RPI = (0.25 * 1) + (0.5 * 0.5) + (0.25 * 7 / 12) = 0.6458333...$

There are some pretty interesting questions you can ask about the RPI. Is it a reasonable measure of team's ability? Is it more important for teams to win games, or to schedule strong opponents? These are all good questions, but for this problem, your task is more straightforward: given a schedule of games, can you calculate every team's RPI?

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each test case begins with a single line containing the number of teams **N**.

The next **N** lines each contain exactly **N** characters (either '0', '1', or '.') representing a schedule in the same format as the example schedule above. A '1' in row *i*, column *j* indicates team *i* beat team *j*, a '0' in row *i*, column *j* indicates team *i* lost to team *j*, and a '.' in row *i*, column *j* indicates team *i* never played against team *j*.

Output

For each test case, output **N** + 1 lines. The first line should be "Case #x:" where x is the case number (starting from 1). The next **N** lines should contain the RPI of each team, one per line, in the same order as the schedule.

Answers with a relative or absolute error of at most 10^{-6} will be considered

correct.

Limits

$1 \leq T \leq 20$.

If the schedule contains a '1' in row i , column j , then it contains a '0' in row j , column i .

If the schedule contains a '0' in row i , column j , then it contains a '1' in row j , column i .

If the schedule contains a '.' in row i , column j , then it contains a '.' in row j , column i .

Every team plays at least two other teams.

No two teams play each other twice.

No team plays itself.

Small dataset

$3 \leq N \leq 10$.

Large dataset

$3 \leq N \leq 100$.

Sample

Input	Output
2	Case #1:
3	0.5
.10	0.5
0.1	0.5
10.	Case #2:
4	0.645833333333
.11.	0.368055555556
0.00	0.604166666667
01.1	0.395833333333
.10.	

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