Problem A. Mixing Bowls

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 5 points	Solve A-small
Large input 9 points	Solve A-large

Problem

You are following a recipe to create your lunch.

The recipe is a mixture made by combining ingredients together in a bowl. Each ingredient will be either:

- Another mixture which you must make first in a separate bowl; or
- A basic ingredient you already have in your kitchen, which can be added directly.

To make a mixture, you need to have all its ingredients ready, take an empty bowl and mix the ingredients in it. It is not possible to make mixtures by adding ingredients to an already-existing mixture in a bowl.

For example, if you want to make CAKE (a mixture) out of CAKEMIX (a mixture) and lies (a basic ingredient), then you must first make CAKEMIX in its own bowl, then add the CAKEMIX and lies to a second bowl to make the CAKE.

Once you have used a mixture as an ingredient and emptied the bowl it was prepared in, you can re-use that bowl for another mixture. So the number of bowls you need to prepare the recipe will depend on the order in which you decide to make mixtures.

Determine the minimum number of bowls you will need.

Input

The first line will contain an integer **C**, the number of test cases in the input file.

For each test case, there will be:

- One line containing an integer **N**, the number of mixtures in the test case.
- **N** lines, one for each mixture, containing:
  - One string giving the mixture name;
  - An integer **M**, the number of ingredients in this mixture;
  - **M** strings, giving the names of each of the ingredients of this mixture.

  The tokens on one line will be separated by single spaces.

  The first mixture in a test case is the recipe you are making.

  The names of mixtures are strings of between 1 and 20 UPPERCASE letters.

  The names of basic ingredients are strings of between 1 and 20 lowercase letters.

  Each mixture is used in exactly one other mixture, except for the recipe, which is not used in any other mixture. Each ingredient will appear at most once in the ingredient list for a mixture. No mixture will (directly or indirectly) require itself as an ingredient.

Output

For each test case, output one line containing "Case #**X**: **Y**" where **X** is the number of the test case, starting from 1, and **Y** is the minimum number of mixing bowls required.

Limits

$1 \le \mathbf{C} \le 10$
$2 \le \mathbf{M} \le 10$

Small dataset

$1 \le \mathbf{N} \le 10$

Large dataset

$1 \le \mathbf{N} \le 1000$

Sample

Input	Output

<pre>2
3
SOUP 3 STOCK salt water
STOCK 2 chicken VEGETABLES
VEGETABLES 2 celery onions
5
MILKSHAKE 4 milk icecream FLAVOR FRUIT
FRUIT 2 banana berries
FLAVOR 2 SPICES CHOCOLATE
SPICES 2 nutmeg cinnamon
CHOCOLATE 2 cocoa syrup</pre>
	<pre>Case #1: 2
	Case #2: 3</pre>

In the first case, to satisfy your craving for SOUP, you follow these steps:

1. Make VEGETABLES by mixing celery and onions in a bowl.
2. Make STOCK in a second bowl by mixing chicken and VEGETABLES from the first bowl. The first bowl becomes empty.
3. Make SOUP in the first bowl by mixing STOCK, salt and water.

In the second case, you have a choice of whether to make FLAVOR or FRUIT first before mixing them with milk and icecream to make MILKSHAKE.

If we make FRUIT first, we use four bowls:

1. Make FRUIT in a bowl by mixing banana and berries.
2. Make SPICES in a second bowl by mixing nutmeg and cinnamon, and CHOCOLATE in a third bowl by mixing cocoa and syrup. (In either order)
3. Make FLAVOR in a fourth bowl by mixing SPICES and CHOCOLATE.
4. Make MILKSHAKE in the second or third bowl by mixing FRUIT, FLAVOR, milk and icecream.

However if we make FRUIT after FLAVOR, we use three bowls:

1. Make SPICES in a bowl by mixing nutmeg and cinnamon, and CHOCOLATE in a second bowl by mixing cocoa and syrup. (In either order)
2. Make FLAVOR in a third bowl by mixing SPICES and CHOCOLATE.
3. Make FRUIT in the first bowl by mixing banana and berries.
4. Make MILKSHAKE in the second bowl by mixing FRUIT, FLAVOR, milk and icecream.

Problem B. Code Sequence

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 7 points	Solve B-small
Large input 15 points	Solve B-large

Problem

You are trying to compute the next number in a sequence S_n generated by a secret code. You know that the code was generated according to the following procedure.

First, for each k between 0 and 29, choose a number C_k between 0 and 10006 (inclusive).

Then, for each integer n between 0 and 1 000 000 000 (inclusive):

- Write n in binary.
- Take the numbers C_k for every bit k that is set in the binary representation of n. For example, when n=5, bits 0 and 2 are set, so C_0 and C_2 are taken.
- Add these C_k together, divide by 10007, and output the remainder as S_n.

You will be given a series of consecutive values of sequence S, but you don't know at which point in the sequence your numbers begin (although you do know that there is at least one more number in the sequence), and you don't know what values of C_k were chosen when the sequence was generated.

Find the next number in the sequence, or output UNKNOWN if this cannot be determined from the input data.

Input

The first line will contain an integer **T**, the number of test cases in the input file.

For each test case, there will be:

- One line containing the integer **N**, the number of elements of sequence S that you have.
- One line containing **N** single-space-separated integers between 0 and 10006, the known elements of the sequence.

Output

For each test case, output one line containing "Case #**X**: **Y**" where **X** is the number of the test case, starting from 1, and **Y** is the next number in the sequence, or the string UNKNOWN if the next number cannot be determined.

Limits

$1 \le \mathbf{T} \le 20$

Small dataset

$1 \le \mathbf{N} \le 5$

Large dataset

$1 \le \mathbf{N} \le 1000$

Sample

Input	Output
3 7 1 2 3 4 5 6 7 4 1 10 11 200 4 1000 1520 7520 7521	Case #1: UNKNOWN Case #2: 201 Case #3: 3514

In the first case, C_0, C_1 and C_2 might have been 1, 2 and 4, and the values of

S_n we have starting at n=1. If this is correct, we don't know C_3, so the next number in the sequence could be anything! Therefore the answer is unknown.

In the second case, we cannot know all the values of C_k or even what n is, but we can prove that in any sequence, if 1, 10, 11, 200 occur in order, then the next value will always be 201.

Submissions

Mixing Bowls
5pt Not attempted **84/92 users** correct (91%)
9pt Not attempted **71/81 users** correct (88%)

Code Sequence
7pt Not attempted **15/21 users** correct (71%)
15pt Not attempted **5/16 users** correct (31%)

Test Passing Probability
5pt Not attempted **59/64 users** correct (92%)
14pt Not attempted **25/37 users** correct (68%)

King
7pt Not attempted **82/94 users** correct (87%)
38pt Not attempted **0/10 users** correct (0%)

Top Scores

Bohua	62
SkidanovAlexander	62
radeye	62
linguo	53
andersk	47
Reid	47
antimatter	47
ploh	47
fuwenjie	47
pmnox	40

Problem C. Test Passing Probability

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 5 points	Solve C-small
Large input 14 points	Solve C-large

Problem

Dave is taking a multiple choice test on the Internet. Dave possibly gets many opportunities to submit his answers to the test, but he passes only if he gets all the questions correct. He must answer every question on the test to make a submission. The only information he receives after he submits is whether he has passed.

For each question, he estimates the probability that each of 4 responses is correct, independent of his responses to other questions. Given a fixed number of submissions he can make, Dave wants to choose his responses so that he maximizes the probability of passing the test.

What is the probability that Dave will pass the test if he chooses his responses optimally?

Input

The first line of input gives the number of cases, **C**. **C** test cases follow.

Each test case starts with a line containing **M** and **Q**. Dave is allowed to make **M** submissions to solve the test. There are **Q** questions on the test. **Q** lines follow, each containing 4 probabilities of correctness. There will be at most 6 digits after the decimal point. The probabilities for each line are non-negative and sum to 1.

Output

For each test case, output one line containing "Case #**X**: **Y**" where **X** is the number of the test case (starting from 1), and **Y** is the probability of success. Answers with a relative or absolute error of at most 10^{-6} will be considered correct.

Limits

$1 \le \mathbf{C} \le 100$

Small dataset

$1 \le \mathbf{Q} \le 6$
$1 \le \mathbf{M} \le 1000$

Large dataset

$1 \le \mathbf{Q} \le 30$
$1 \le \mathbf{M} \le 10000$

Sample

Input	Output
3 10 2 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25 64 3 0.3 0.4 0.0 0.3 1.0 0.0 0.0 0.0 0.2 0.2 0.2 0.4 3 2 0.5 0.17 0.17 0.16 0.5 0.25 0.25 0.0	Case #1: 0.625 Case #2: 1.0 Case #3: 0.5

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Problem D. King

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 7 points	Solve D-small
Large input 38 points	Solve D-large

Problem

Alice and Bob want to play a game. The game is played on a chessboard with **R** rows and **C** columns, for a total of **RC** squares. Some of these squares are burned.

A king will be placed on an unburned square of the board, and Alice and Bob will make successive moves with the king.

In a move, the player must move the king to any of its 8 neighboring squares, with the following two conditions:

- The destination square must not be burned
- The king must never have been in the destination square before.

If a player can't make a move, he or she loses the game. Alice will move first; you need to determine who will win, assuming both players play optimally.

Input

The first line of input gives the number of cases, **N**.

N test cases follow. The first line of each case will contain two integers, **R** and **C**. The next **R** lines will contain strings of length **C**, representing the **C** squares of each row. Each string will contain only the characters '.', '#' and 'K':

- '#' means the square is burned;
- '.' means the square is unburned, and unoccupied; and
- 'K' means the king is in that cell at the beginning of the game.

There will be only one 'K' character in each test case.

Output

For each test case, output one line containing "Case #**X**: " (where **X** is the case number, starting from 1) followed by A if Alice wins, or B if Bob wins.

Limits

1 ≤ **N** ≤ 100

Small dataset

1 ≤ **R**, **C** ≤ 4

Large dataset

1 ≤ **R**, **C** ≤ 15

Sample

Input	Output
2 2 2 K. .# 4 2 K# .# .# .#	Case #1: B Case #2: A