ICPC SOUTH PACIFIC PRELIMINARY CONTEST LEVEL B

AUGUST 31, 2024

Contest Problems

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This contest contains twelve problems. Good luck.

For problems that state "*Your answer should have an absolute or relative error of less than* 10^{-9}", your answer, x, will be compared to the correct answer, y. If $|x-y| < 10^{-9}$ or $\frac{|x-y|}{|y|} < 10^{-9}$, then your answer will be considered correct.

Definition 1

For problems that ask for a result modulo m:
If the correct answer to the problem is the integer b, then you should display the unique value a such that:

- $0 \leq a < m$
  and
- $(a-b)$ is a multiple of m.

Definition 2

A string $s_1 s_2 \cdots s_n$ is lexicographically smaller than $t_1 t_2 \cdots t_\ell$ if

- there exists $k \leq \min(n, \ell)$ such that $s_i = t_i$ for all $1 \leq i < k$ and $s_k < t_k$
  or
- $s_i = t_i$ for all $1 \leq i \leq \min(n, \ell)$ and $n < \ell$.

Definition 3

- Uppercase letters are the uppercase English letters $(A, B, \ldots, Z)$.
- Lowercase letters are the lowercase English letters $(a, b, \ldots, z)$.

Definition 4

Unless otherwise specified, the distance between two points (x_0, y_0) and (x_1, y_1) is defined as its Euclidean distance:

$$\sqrt{(x_0 - x_1)^2 + (y_0 - y_1)^2}.$$

Problem A
An Introduction
Time limit: 1 second

This problem is intended to be an easy problem to get you familiar with the judging system.

All input and output (in all problems) is given via `stdin` and `stdout`. So you should use `input()`/`print()` in Python, `std::cin`/`std::cout` in C++, and `Scanner`/`System.out.println()` in Java to read and write to our system. Good luck!

Janine's favourite game involves rolling a 100-sided die, with the numbers 1 through 100 each appearing on exactly one of the faces. Each face has a 1% chance of being rolled. Janine's friend James just rolled their die. Janine wants to know what the probability is of rolling a higher number than James' roll. For example, if James rolled a 50, then Janine has a 50% chance of rolling a 51 or higher. And if James rolled a 100, then Janine has a 0% chance of rolling higher, since no face is larger than 100.

Given James' roll, what is Janine's probability of rolling a higher number?

Input

The input consists of a single line containing a single integer R ($1 \leq R \leq 100$), which is the value of James' roll.

Output

Display the probability (as an integer percentage) of Janine rolling a higher number than James.

Sample Input 1	Sample Output 1
50	50

Sample Input 2	Sample Output 2
100	0

Sample Input 3	Sample Output 3
1	99

Sample Input 4	Sample Output 4
23	77

Sample Input 5	Sample Output 5
75	25

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Problem B
Birthday Wizard
Time limit: 1 second

Nathan is a wizard, who is turning N years old today. He is very lonely and awkward, so each year he celebrates his birthday alone.

Last year, he turned $N - 1$ years old, so he decorated his birthday cake with $N - 1$ candles. However, he felt that this was a waste of candles, and started thinking of more concise ways to represent his age. Eventually, using his wizard powers, he recognised that the traditional system represents his age in unary (base 1). This year, he plans to save candles by expressing his age in a different base.

For example, suppose Nathan turns five this year.

- The traditional unary representation is `11111`, with each digit represented by an individual candle, using five candles in total.
- If he instead uses ternary (base 3), his age could be written as `12`. He could represent this with one candle for the `1`, and a cluster of two candles for the `2`, for a total of three candles.
- Binary (base 2) is even better; in this system his age is `101`. He can place one candle for the first digit, leave a gap to represent the `0`, and place the second and final candle to represent the third digit.
- The best of all is base 5, where his age is `10`, requiring only one candle.

As Nathan always celebrates his birthday alone, he is not concerned with ambiguity. In particular, it does not matter that `101` could be misinterpreted as `11` or `1001`, or that `12` might be read as `21` from the other side of the cake.

Nathan would like to use as few candles as possible, by choosing an appropriate base between 2 and 10 inclusive. Help Nathan determine the smallest number of candles to use.

Input

The input consists of a single line containing a single integer N ($1 \leq N \leq 10^{18}$), the age to be represented on Nathan's cake this year.

Output

Display the smallest number of candles that Nathan can use.

Sample Input 1	Sample Output 1
5	1

Sample Input 2	Sample Output 2
51	3

Sample Input 3	Sample Output 3
1000000000000	1

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Problem C
Contest Strategy
Time limit: 1 second

In ICPC-style competitions, determining the difficulty of problems is crucial for contestants. The scoreboard gives a lot of information about a problem's difficulty. You can often determine if it is easy, medium, or hard just based on how many teams solve it. The more teams that solve it, the easier it likely is.

You can also determine if it is *tricky*. Tricky problems are ones that have a non-obvious corner case or where the obvious solution is too slow (remember: a Time Limit Exceeded verdict normally means that your algorithm is too slow, not that your implementation is too slow). Tricky problems often appear on the scoreboard as lots of incorrect submissions.

Jenna has the following strategy for classifying a problem's difficulty:

1. A problem is *easy* if more than half of the teams in the contest have solved it.
2. A problem is *hard* if fewer than 20% of teams have solved it.
3. A problem is *tricky* if the number of incorrect submissions is more than twice the number of correct submissions.
4. A problem is *medium* if none of the above apply.

If a problem satisfies multiple classifications, then classify it as the first in the list (that is, prefer easy, then hard, then tricky, then medium).

Given the current state of the scoreboard for a particular problem, classify the difficulty of that problem.

Input

The first line of input contains a single integer n ($1 \le n \le 100$), which is the number of teams in the contest.

The next line contains n integers $s_1, s_2, \ldots, s_n$ ($-100 \le s_i \le 100$), which is the current scoreboard for each of the n teams. If s_i is negative, then team i has made s_i incorrect submissions for this problem. If s_i is positive, then team i has made s_i submissions for this problem, $s_i - 1$ of them are incorrect and one of them is correct. If s_i is 0, then team i has made no submissions for this problem.

The sample input is the scoreboard from problems A-D in the 2023 South Pacific Regional Finals.

Output

Display the difficulty of the problem.

Sample Input 1

```
12
2 5 0 -1 0 0 3 -2 0 0 0 0
```

Sample Output 1

```
tricky
```

Sample Input 2

```
12
1 1 3 2 2 1 2 1 2 1 1 4
```

Sample Output 2

```
easy
```

Sample Input 3

```
12
2 2 -7 -6 0 0 0 0 0 0 0 0
```

Sample Output 3

```
hard
```

Sample Input 4	Sample Output 4
12 2 2 1 2 1 3 0 -2 0 0 0 0	medium

Problem D
Delightful Stick Arrangements
Time limit: 2 seconds

Janine has a collection of sticks, each with a unique length. She wants to arrange these sticks in such a way that for any three consecutive sticks, the median length of the three is not the middle stick. This specific arrangement is called a *delightful* order.

For instance, if Janine has sticks with lengths 2, 3, 5, 7, 11, 13, and 17, she can order them as follows: 13, 5, 7, 2, 17, 3, 11. In this arrangement, the medians of each triplet $(13, 5, 7)$, $(5, 7, 2)$, $(7, 2, 17)$, $(2, 17, 3)$, and $(17, 3, 11)$ are 7, 5, 7, 3, and 11 respectively, and none of these medians are the middle stick of the triplet, so this is a delightful order.

Janine has proven that a delightful ordering is always possible, but is having a hard time finding one. Given the lengths of the sticks, arrange them in a delightful order.

Input

The first line of input contains a single integer n ($3 \leq n \leq 2\,000$), which is the number of sticks.

The next line contains n distinct integers s_i ($1 \leq s_i \leq 100\,000$), which are the lengths of the n sticks.

Output

Display a delightful ordering. If there are multiple correct solutions, any will be accepted.

Sample Input 1

```
7
2 3 5 7 11 13 17
```

Sample Output 1

```
13 5 7 2 17 3 11
```

Sample Input 2

```
4
10 100 1 1000
```

Sample Output 2

```
1000 1 100 10
```

Sample Input 3

```
8
1 3 5 7 2 4 6 8
```

Sample Output 3

```
1 6 4 8 5 7 2 3
```

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Problem E
Efficient Elevators
Time limit: 4 seconds

Jeremy lives in a large skyscraper with efficient elevators that travel at 1 floor per second and hold an unlimited number of passengers. The elevators require so much power that they need to recharge every day after being used. So each day, each elevator starts at the ground floor and immediately goes up to some floor. Then, each elevator waits for some time. Finally, each elevator goes all the way down to the ground floor, and then cannot be used again until tomorrow. Note that the elevators might go up to different floors to wait and might go back to ground floor at different times.

Every morning, all tenants need to travel from their respective floors to the ground floor (floor 0). Tenants are impatient and require immediate access to an elevator when they request it. It takes no time to enter the elevator, and the elevators do not slow down as they pick up passengers. Elevators do not collect tenants on their way up, only on the way down to ground floor. This is because the elevators power on and go to their waiting position before any tenants wake up. Tenants only use elevators in the morning; they all take the stairs in the evening when they come home.

For example, if Betty requests an elevator on floor 4 at time 5 and Charlie requests an elevator on floor 3 at time 6, then they can share the same elevator (since the elevator is on floor 4 at time 5, floor 3 at time 6, floor 2 at time 7, floor 1 at time 8, and the ground floor at time 9). Anyone who requests an elevator at any of these times on those floors may also share the same elevator. Similarly, someone on floor 7 at time 2 could share this elevator. Someone on floor 1 at time 10 cannot use this same elevator since the elevator needs to recharge until tomorrow after reaching the ground floor.

Your goal is to minimise the number of elevators while ensuring all tenants can board without delay. Given the floor and time each tenant requests an elevator, compute the minimum number of elevators needed.

Input

The first line of input contains a single integer n ($1 \leq n \leq 500\,000$), which is the number of tenants.

The next n lines describe the tenants. Each of these lines contains two integers r ($1 \leq r \leq 10^9$), which is the time in seconds that this tenant requested the elevator, and f ($1 \leq f \leq 10^9$), which is the floor they are on when they request the elevator.

Output

Display the minimum number of elevators needed.

Sample Input 1

```
2
5 4
6 3
```

Sample Output 1

```
1
```

Sample Input 2

```
3
1 4
2 3
3 4
```

Sample Output 2

```
2
```

Sample Input 3	Sample Output 3
3 1 1 1 2 1 3	3

Sample Input 4	Sample Output 4
3 1 1 1 1 1 1	1

Sample Input 5	Sample Output 5
3 3 3 2 2 1 1	3

Problem F
Falling Blocks
Time limit: 4 seconds

There is a hot new platform game. It is called Marizzo and features a plumber who fixes skibidi toilets. The game is very popular and Mary has pitched a new startup to venture capital investors. Her startup idea is simple, use AI to play the game so that impressive speed-runs can be generated automatically and uploaded as NFTs to TouYube to collect ad revenue. Unfortunately, the deep learning methods Mary planned to use are not working well on Marizzo. You have been hired to develop an algorithm that can play the game optimally.

The game is played in a 2D space with width W and unlimited height. A sequence of N blocks fall from the sky one after the other. The game lasts a total of $N+1$ seconds. During the ith second, a block with a width and height of 1 falls from above. The ith block falls at location l_i and falls directly down vertically. Each block will collide with either the ground or another block at the end of the ith second. Once it collides with anything, it stops there for the remainder of the game. No block falls in the final second of the game (the $N+1$-th second).

The player controls Marizzo and can move him left or right. Marizzo has a height and width of 1 and can move very fast completing as many steps as needed between falling blocks. He can climb up or down to an adjacent block so long as the height difference between his current location is at most 1. Formally, Marizzo can step from location x to location y only if $|x-y|=1$ and $|H_x - H_y| \leq 1$ where H_x denotes the height of location x. If a block falls on Marizzo, he will be crushed and the game is over. The goal of the game is to survive as long as possible so the score is the number of seconds survived. Note that if Marizzo can survive until the end of the game, that gets a score of $N+1$.

Input

The first line of input contains two integers, N ($1 \leq N \leq 200,000$) and W ($1 \leq W \leq 200,000$). The next line contains N integer describing the sequence of falling blocks. The ith integer is the location of the ith block, l_i ($1 \leq l \leq W$).

Output

Display the maximum possible score.

Sample Input 1

```
4 4
1 2 3 4
```

Sample Output 1

```
5
```

Sample Input 2

```
4 2
1 1 2 2
```

Sample Output 2

```
3
```

Sample Input 3

```
6 2
1 1 1 2 2 2
```

Sample Output 3

```
4
```

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Problem G
Grouping Words
Time limit: 1 second

The puzzle club at your university is working on a new word association game. The game consists of nine words, arranged in a three-by-three grid. To win the game, a player has to categorise the words into three groups of three words each, so that each pair of words in the same group is related.

Consider the example below.

PACIFIC	NEW	FIJI
PROGRAMMING	ZEALAND	CPLUSPLUS
PYTHON	SOUTH	JAVA

A player would be expected to know of many related words:

- all pairs of words in "South Pacific Competitive Programming Association",
- all pairs of words in country names (Australia, New Zealand, South Africa, and Fiji) are related to each other, and
- all pairs of programming languages (C++, Python, and Java) are related to each other.

There is only one way to group these words into three groups of three:

PACIFIC	*NEW*	*FIJI*
PROGRAMMING	*ZEALAND*	CPLUSPLUS
PYTHON	**SOUTH**	JAVA

The club needs your help to check whether a given puzzle can be solved or not! Given a grid of words, and a list of pairs of related words from the grid, report whether the puzzle can be solved, and if so, find a valid grouping.

Input

The first three lines of input each contain three words, and each word comprises up to 15 uppercase letters. All nine words are distinct.

The next line contains a single integer m ($9 \leq m \leq 36$), which is the number of pairs of related words.

The next m lines each represent a pair of related words. Each such line contains two distinct words out of the nine listed in the first three lines. No pair of related words appears more than once (in either ordering). So if `a b` appears, then `b a` does not.

Output

If there is no valid grouping, display `Impossible`.

Otherwise, display `Possible`, then three lines each containing three words. Each of these lines must correspond to a group, so the first three words must be pairwise related, as well as the next three, and the final three.

Sample Input 1

```
CCC A AAA
DDD DDDD BB
DD BBB D
18
BBB DDD
DDDD CCC
A DD
A D
DD DDDD
CCC DDD
BB BBB
BB DD
DDD DDDD
AAA D
D BBB
DDD D
DD DDD
DD D
AAA A
DDDD D
DD BBB
A DDDD
```

Sample Output 1

```
Possible
CCC DDD DDDD
A AAA D
BB DD BBB
```

Sample Input 2

```
PACIFIC NEW FIJI
PROGRAMMING ZEALAND CPLUSPLUS
PYTHON SOUTH JAVA
12
SOUTH PACIFIC
SOUTH PROGRAMMING
PROGRAMMING PACIFIC
SOUTH ZEALAND
SOUTH FIJI
NEW ZEALAND
NEW FIJI
NEW SOUTH
FIJI ZEALAND
CPLUSPLUS JAVA
CPLUSPLUS PYTHON
JAVA PYTHON
```

Sample Output 2

```
Possible
PACIFIC PROGRAMMING SOUTH
NEW FIJI ZEALAND
CPLUSPLUS PYTHON JAVA
```

Sample Input 3	Sample Output 3
A AA AAA B BB BBB C CC CCC 12 A AA AA AAA B BB BB BBB C CC CC CCC A B AA BB AAA BBB A C AA CC AAA CCC	Impossible

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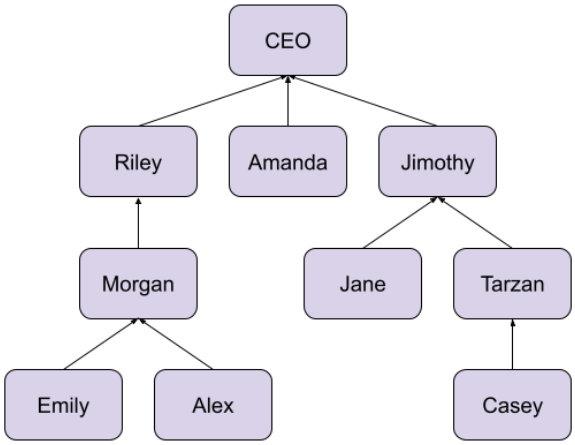
Problem H
Human Resources
Time limit: 1 second

James works at MegaCorp, where every employee except the CEO has exactly one manager. An employee's reporting chain includes themselves, their manager, their manager's manager, and so on. The CEO is at the top of everyone's reporting chain. MegaCorp needs to train some employees so that each employee can communicate with a trained manager.

The distance between an employee and someone in their reporting chain is defined as the number of managers between them, plus one. For example, an employee's direct manager is at distance 1, their manager's manager is at distance 2, and so forth. The distance from am employee to themself is 0. MegaCorp's policy dictates that for every employee (including the CEO), the distance to the nearest trained manager in their reporting chain (including themself) must be at most K.

Consider the following employee structure:



If $K = 5$, training the CEO alone suffices because everyone is within a distance of 5 from them. However, if $K = 2$, at least one additional manager needs training because some employees are at a distance of 3 from the CEO. Training the CEO, Morgan, and Tarzan is enough to satisfy the requirements.

Given the manager for each employee, determine the minimum number of managers that MegaCorp needs to train to ensure that every employee is within at most distance K from a trained manager in their reporting chain.

Input

The first line of input contains two integers n ($2 \leq n \leq 300$), which is the number of employees, and K ($1 \leq K \leq n$), which is the maximum distance from an employee to the nearest trained manager.

The next line contains $n - 1$ integers $m_2, m_3, \ldots, m_n$ ($1 \leq m_i < i$), which indicates that the manager of employee i is m_i. The CEO is employee 1.

Output

Display the minimum number of managers that MegaCorp needs to train.

Sample Input 1	Sample Output 1
10 5 1 1 1 2 4 4 5 5 7	1

Sample Input 2	Sample Output 2
10 2 1 1 1 2 4 4 5 5 7	3

Problem I
Iguana Gift
Time limit: 1 second

The legendary iguanas Izzy and Iggy have been married for almost two years now! Izzy said that as an anniversary gift she wants a really nice palindrome. A palindrome is a string that is the same forwards and backwards.

Iggy wants to give Izzy the perfect palindrome, but he unfortunately procrastinated. Iggy currently has a string (which may or may not already be a palindrome). Iggy and Izzy's anniversary date is in just a few minutes so Iggy needs your help making a palindrome from what he has so far as quick as possible. However, Iggy likes what he has so far so the resulting palindrome must start with his original string.

What is the minimum number of characters Iggy must add to the end of his string to create a palindrome?

Input

The first and only line of input contains a single string consisting of at least 1 and at most 20 lowercase letters. This is the string Iggy currently has.

Output

Display the minimum number of letters Iggy needs to add to the end of his string to form a palindrome that starts with his original string.

Sample Input 1	Sample Output 1
iloveyou	7

Sample Input 2	Sample Output 2
xoxoxoxoxoxoxoxoxoxo	1

Sample Input 3	Sample Output 3
icpc	1

Sample Input 4	Sample Output 4
tacocat	0

Sample Input 5	Sample Output 5
x	0

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Problem J
Jimothy the Monster Hunter
Time limit: 1 second

Jimothy is facing the final boss in his favourite game, *Monster Hunter*. The boss has h hit points (HP), and Jimothy possesses potions and swords to diminish the boss's HP. Potions reduce the boss's HP by a percentage equal to the potion's potency, while swords reduce the boss's HP by a flat amount equal to their strength.

Items may be used in any order. For example, if Jimothy has a potion with 30 potency and a sword with 20 strength against a boss with 50HP, using the potion first would leave the boss with 35HP (30% off 50HP $=$ 35HP), and using the sword afterward would further reduce it to 15HP (35HP $-$ 20HP $=$ 15HP). Alternatively, using the sword first and then the potion would leave the boss with 21HP (50HP $-$ 20HP $=$ 30HP and 30% off 30HP $=$ 21HP). Potion percentages are calculated based on the boss's current HP, so if Jimothy had two potions with 50 potency each, using them would reduce the boss to 25% of its original HP (the first potion removes 50%, then the second potion removes 50% of the remaining, leaving 25% of the original HP).

The boss's HP can even drop below zero, though potions have no effect when the boss's HP is negative (swords still reduce the boss's HP). So if the boss has -10HP, then potions have no effect, and a sword with 5 strength would reduce the boss's HP to -15HP.

Each item can only be used once, and Jimothy has a limit, L, on the total number of items he can use. For instance, if the limit is 2 items, he could use 2 swords and 0 potions, 2 potions and 0 swords, or 1 of each. Jimothy aims to minimise the boss's remaining HP after using the items.

Given the potencies of the potions, strengths of the swords, and a restriction on the number of items Jimothy can use, determine the minimum HP the boss can have after using up to the allowed number of items.

Input

The first line of input contains four integers h ($1 \leq h \leq 100\,000$), which is the initial HP of the boss, n ($1 \leq n \leq 1\,000$), which is the number of potions Jimothy has, m ($1 \leq m \leq 1\,000$), which is the number of swords Jimothy has, and L ($1 \leq L \leq n + m$), which is the limit on the number of items they can use.

The second line contains n integers $p_1, p_2, \ldots, p_n$ ($1 \leq p_i \leq 99$), which are the potencies of the potions.

The third line contains m integers $s_1, s_2, \ldots, s_m$ ($1 \leq s_i \leq 100$), which are the strengths of the swords.

Output

Display the minimum HP the boss can have after using up to the allowed number of items. Your answer should have an absolute or relative error of less than 10^{-4}.

Sample Input 1	Sample Output 1
50 1 1 1 30 20	30.0000000000

Sample Input 2	Sample Output 2
50 1 1 2 30 20	15.0000000000

Sample Input 3	Sample Output 3
100 2 1 2 50 50 10	25.0000000000

Sample Input 4	Sample Output 4
100 2 1 2 50 90 1	5.0000000000

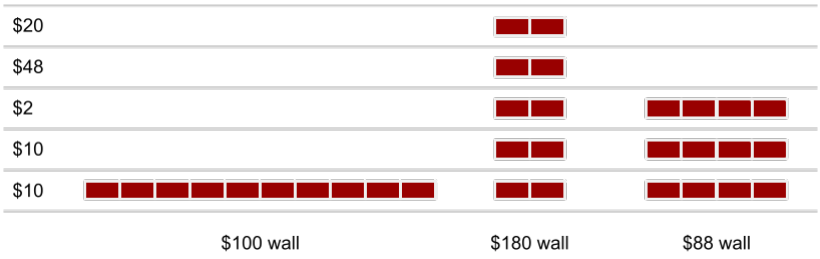
Sample Input 5	Sample Output 5
100 2 2 2 10 50 5 25	25.0000000000

Sample Input 6	Sample Output 6
5 2 1 2 10 5 10	-5.5000000000

Problem K
King John IV the Builder
Time limit: 1 second

King John has been tasked with building a wall that must contain at least K bricks. The bricks need to be distributed evenly across several layers. If the wall is ℓ layers tall, then John must place the same number of bricks on layers 1 through ℓ (and no bricks on any other layer). The cost of a brick varies depending on the layer it is placed on.

For example, suppose John needs to build a wall with at least 10 bricks, and the costs per brick for layers 1 through 5 are \$10, \$10, \$2, \$48, and \$20, respectively. One option is to place all 10 bricks on layer 1, costing a total of \$100. He could also place 2 bricks on each of the five layers costing a total of \$180. But by using 12 bricks instead, he could distribute 4 bricks each on layers 1, 2, and 3, resulting in a total cost of \$88.



Given the minimum number of bricks in the wall and the cost per brick for each layer, what is the minimum cost required to build a wall that satisfies the constraints?

Input

The first line of input contains two integers K ($1 \leq K \leq 1\,000$), which is the minimum number of bricks needed in the wall, and M ($1 \leq M \leq K$), which is the maximum height of the wall.

The next line contains M integers $c_1, c_2, \ldots, c_M$ ($1 \leq c_i \leq 1\,000\,000$), which is the cost of placing a brick on the ith layer.

Output

Display the minimum cost required to build a wall that satisfies the constraints.

Sample Input 1	Sample Output 1
10 5 10 10 2 48 20	88

Sample Input 2	Sample Output 2
3 3 5 3 1	9

Sample Input 3	Sample Output 3
2 2 1 5	2

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Problem L
LLM
Time limit: 1 second

Large Language Models (LLMs) are super popular these days. However, you need tons of compute power in order to use them. As complex as they seem, the basics of LLMs are pretty straight forward: given previous context, generate the next word/token/letter using some predetermined formulas. Janet wants to build a simplified version of this. This simplified LLM is called JanetBot. JanetBot can only generate 27 letters: the 26 lowercase letters and the *stop token* (described below).

JanetBot works by generating one letter at a time. To determine which letter to generate next, JanetBot looks at the last letter in the already generated text, computes a probability distribution, and then randomly selects a letter to append to the text from that probability distribution. The process then repeats for the next letter, and the next, and the next, until JanetBot generates the *stop token*, which is a special letter telling JanetBot to stop generating. The stop token is not appended to the text.

How do we compute that probability distribution? We train JanetBot! We give JanetBot many examples (called *training data*) of real text so that it can adjust its probabilities so that it generates reasonable text. Say ℓ_0 was the most recently generated letter, then the probability of generating some letter ℓ_1 (ℓ_1 may or may not be the stop token) is

$$\frac{\text{\# of times the substring `}\ell_0\ell_1\text{' appears in the training data}}{\text{\# of times `}\ell_0\text{' appears in the training data}}.$$

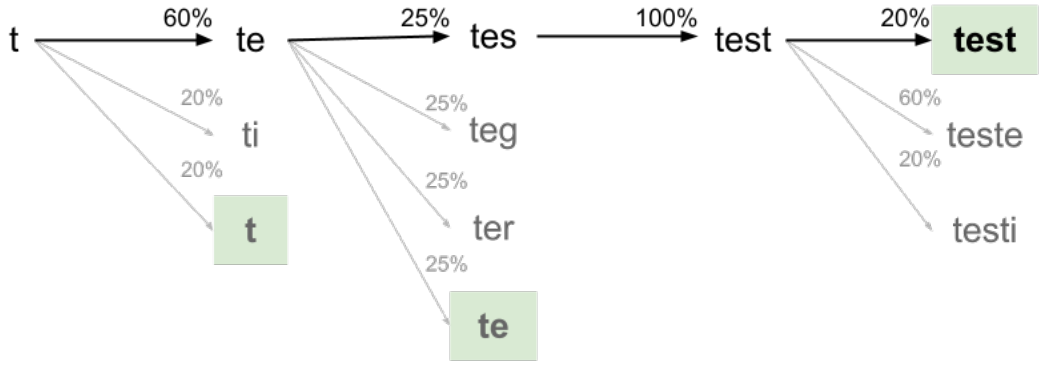
If ℓ_0 does not appear in the training data, then JanetBot will always generate the stop token as the next letter. There is a stop token at the end of each word in the training data.

For example, if the training data consists of 4 words: `international`, `collegiate`, `programming`, and `contest`, and the existing text is `test`, then the probability distribution for the next letter depends on the `t`'s in the input and is as follows:

Next Letter	`e`	`i`	Stop Token	Everything Else
Probability	$\frac{3}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{0}{5}$

Thus, there is a 60% chance the `e` is selected (making the text `teste`) and generation continues with the probability distribution described by the `e`'s in the input. There is a 20% chance the `i` is selected (making the text `testi`) and the generation continues. And there is a 20% chance the stop token is selected and the final text is `test`. On the other hand, if the original text was `xyz`, then JanetBot is guaranteed to generate the stop token next since `z` does not appear in the training data.

So if JanetBot wants to generate the full word `test` (with `t` as the original text), then there is a 60% chance to generate an `e` following a `t`, 25% to generate an `s` following an `e`, 100% chance of generating a `t` following an `s`, and a 20% chance to generate the stop token after a `t`. Since these chances are independent, the total probability is $60\% \times 25\% \times 100\% \times 20\% = 3\%$.



Janet is validating that JanetBot works properly. She has a target text she is attempting to generate. The text starts as the first letter of the target text. Given the training data and a target text, what is the probability that JanetBot generates the remainder of the target text?

Input

The first line of input contains a single string T, which is the target string (T consists of only lowercase letters and has a length between 1 and 20, inclusive).

The second line of input contains a single integer n ($1 \leq n \leq 100$), which is the number of words in the training data.

The next n lines describe the training data. Each of these lines contains a single string S, which is a word in the training data (S consists of only lowercase letters and has a length between 1 and 20, inclusive).

Output

Display the probability that JanetBot generates T, given that it has already generated the first letter of T. The probability is a value between 0 and 1 inclusive. Your answer will be considered correct if it has an absolute or relative error of less than 10^{-9}.

Sample Input 1

```
test
4
international
collegiate
programming
contest
```

Sample Output 1

```
0.030000000000
```

Sample Input 2

```
ab
2
jab
table
```

Sample Output 2

```
0.500000000000
```

Sample Input 3

```
x
3
x
xy
xyz
```

Sample Output 3

```
0.333333333333
```

Sample Input 4

```
abc
1
ab
```

Sample Output 4

```
0.000000000000
```

Sample Input 5

```
aa
1
aa
```

Sample Output 5

```
0.250000000000
```

Sample Input 6	Sample Output 6
a 3 a a aa	0.750000000000

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