Problem A. Alternating Serves

Time limit: 2 seconds

It's Friday night, so Darcy and Rajko are playing table tennis in the maths building. Despite Darcy's insistence that the "official rules" dictate that each player should make two serves each time the server is switched, followed by single alternating serves if a score of 10-10 is reached, everybody has agreed to play by the "unofficial rules" which state that the server alternates every five points.

Darcy is first to serve, meaning that he will make the first five serves, followed by Rajko who will make the next five serves and so on. Since it is Friday night, Darcy and Rajko are having trouble keeping track of who is serving next, so they need your help in writing a program that will remind them.

Given the current score of the match, figure out who is serving the next point, given that Darcy serves first and that the server alternates every five points.

Input

The input will consist of a single line containing two integers d $(0 \le d \le 10)$ and r $(0 \le r \le 10)$, which denote Darcy and Rajko's current scores, respectively.

Output

Display either `Darcy` or `Rajko`, the name of the player whose turn it is to serve.

Examples

test	answer
1 1	Darcy
4 7	Darcy
9 8	Rajko
0 0	Darcy

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Problem B. Break From Training

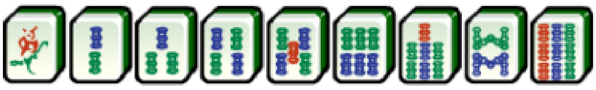
Time limit: 2 seconds

Since the ICPC World Finals is only a few weeks away, the Monash Team (consisting of Xin Wei, Peter and Daniel) have been practicing hard. Not wanting to get too stressed out before the big day, they ask Darcy for a break in their training. Darcy, being the tyrant he is, refuses and insists that play a game of Mahjong, which is one of his top-secret training methods. The rules of Darcy's Mahjong (which are a subset of the actual game) are described in detail below.

Tiles

A Mahjong tile is represented by a string of length 2 (e.g., **1C**, **9D**, **4B**). The first character denotes the number etched on the tile, which can take a value in the range $1-9$. The second character denotes the suit of the tile. Mahjong tiles belong to 3 different suits namely:

- Bamboo (represented by **1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, 9B**)



- Character (represented by **1C, 2C, 3C, 4C, 5C, 6C, 7C, 8C, 9C**)

- Dot (represented by **1D, 2D, 3D, 4D, 5D, 6D, 7D, 8D, 9D**)

There are 4 copies of each of the 27 tiles described above, resulting in a total of 108 tiles.

Starting the game

Daniel will always make the first move, followed by Darcy, Xin Wei and Peter. After Peter makes his move, Daniel will move again and begin a new cycle.

The game of Mahjong begins by shuffling the Mahjong tiles to produce a random permutation of the 108 tiles. This is followed by 4 rounds where each player draws tiles to form their initial hand. In the first 3 rounds, 4 tiles are drawn by each player and in the final round, only 1 tile is drawn by each player. This results in every player having a hand of 13 tiles.

The remaining tiles form a pool that is drawn from over the course of the game.

Playing the game

Beginning with Daniel, each player will take turns making moves until someone announces that they have won or if there are no tiles left to draw from.

A move consists of 3 steps:

1. Draw a single tile and place it into their hand.

2. Determine if a winning hand is obtained.
3. Discard a single tile.

A winning hand is obtained if a player successfully uses all 14 of their tiles to produce four *sets* and a *pair*. A set consists of three consecutive tiles of the same suit (e.g., **5B, 6B, 7B**) and a pair consists of two identical tiles (e.g., **4D, 4D**). Each tile can only be used in one set or one pair. If a winning hand is announced, the game is over. Note that a player may have a winning hand and not announce it, in which case, the game continues. If the game concludes without a winner, the game is declared a draw.

Playstyle

Each player has their own unique play style, described below.

- Daniel favours tiles with low numbers. For tiles that are of the same suit, he considers the tiles from smallest to largest. For each tile under consideration, he will attempt to form a set using that tile immediately. If such a set exists, he puts the set of tiles aside (if multiple sets can be made, it does not matter which set he takes since they all must contain the same tile values). After going through each suit, he will announce his victory if he has managed to form a winning hand. If not, he will discard the tile with the highest number, breaking ties by suit (**B** is discarded first followed by **C** and then **D**).

  As an example, if Daniel's hand is

  1B, 2B, 3B, 4B, 4B, 1C, 2C, 3C, 1D, 2D, 3D, 5D, 6D, 7D

  then he will take

  $$\underbrace{\text{1B, 2B, 3B}}, \text{4B, 4B, } \underbrace{\text{1C, 2C, 3C}}, \underbrace{\text{1D, 2D, 3D}}, \underbrace{\text{5D, 6D, 7D}}$$

  as the three sets, leaving the pair to win the game. However, if Daniel's hand is

  1B, 1B, 2B, 3B, 4B, 1C, 2C, 3C, 1D, 2D, 3D, 5D, 6D, 7D

  then Daniel will set aside

  $$\text{1B, } \underbrace{\text{1B, 2B, 3B}}, \text{4B, } \underbrace{\text{1C, 2C, 3C}}, \underbrace{\text{1D, 2D, 3D}}, \underbrace{\text{5D, 6D, 7D}}$$

  and then discard the 7D since he thinks he did not win; even though he could have won by taking the two 1B tiles as his pair.

- Darcy plays the complete opposite to Daniel. Darcy favours tiles with higher numbers. For tiles that are of the same suit, he considers the tiles from largest to smallest. For each tile under consideration, he will attempt to form a set using that tile immediately. If he is successful, he puts the set of tiles aside. After going through each suit, he will announce his victory if he has managed to form a winning hand. If not, he will discard the tile with the lowest number, breaking ties by suit (**D** is discarded first followed by **C** and then **B**)

- Xin Wei is too lazy to move his tiles around. He always recognises when he has a winning hand but he always discards the tile that he just picked up.

- Peter always recognises when he has a winning hand but his discards are decided randomly. He arranges his tiles in order of when they were received such that the earliest tile received is at index 0 and the most recent tile received is at index 13. The first tile he discards is at index A and every subsequent discard is the sum of the previous index and B (mod 14). For example, if $A = 10$ and $B = 3$, then on Peter's first 3 turns, he will discard the tiles at index 10, 13, 2, respectively.

Input

The first line of the input consists of a permutation of the 108 Mahjong tiles in the order they will be drawn from the pile. The second line contains 2 integers A ($0 \le A \le 13$) and B ($0 \le B \le 13$), which are the values used in Peter's strategy.

Output

If someone wins the game, display the name of the winner (either `Daniel`, `Darcy`, `Peter` or `Xin Wei`). If the game ends without a winner, display the word `Drawn`.

Examples

test	answer
7C 1C 7D 7B 9C 8D 7B 5D 5B 5C 2C 4B 7C 9C 3B 5B 8D 9B 2D 8B 1D 4D 1B 5C 1D 2D 4D 8B 6D 8C 7C 5D 3D 3C 9D 2C 8B 1B 1C 6B 8D 9C 8C 2D 1C 2B 3D 4B 1D 6B 6D 9D 9B 5D 6D 4B 3C 6C 7C 2B 2D 3C 7D 3B 7D 7B 4C 7B 4C 4C 5D 6B 9B 5B 7D 3B 4B 4C 6C 4D 6B 9D 6C 9D 6C 5B 2C 9C 3C 1D 1C 9B 4D 5C 8D 5C 3B 2B 3D 1B 8C 2B 8B 2C 3D 6D 8C 1B 6 1	Peter
5D 5B 4C 9C 6C 9B 4C 8B 9B 9D 1C 3C 9B 1C 6D 8B 8C 7D 5C 6C 2B 3D 4D 3C 6C 2C 6D 2D 2D 8D 8B 9C 4C 7C 6D 3C 5C 3B 4B 4B 8C 2D 3D 7C 9D 6B 1B 8D 5C 3B 2B 7B 5B 3D 3C 6B 4C 7D 1D 6D 5B 4D 9C 4B 9D 1C 1C 7B 8C 3B 1B 5C 5B 5D 6B 4D 7B 5D 2C 3D 8D 8C 7D 7B 1B 2B 6C 3B 4B 8D 9D 2D 7D 1B 4D 7C 9B 6B 2B 8B 9C 1D 5D 2C 1D 2C 1D 7C 0 1	Daniel
7B 4C 4D 2B 6C 9C 3D 8D 9C 3C 7D 6D 6C 2B 9B 5C 2D 9B 3B 2C 3C 2B 7B 8B 4D 1D 3B 2B 4B 5B 4C 5B 4C 6D 3D 5B 7D 6B 5D 3B 7B 9D 1D 3D 7C 2D 6B 7D 9C 6D 8D 1D 7C 1D 8B 8C 5C 4D 1B 1C 9D 9B 6B 6C 4B 8C 9B 8D 1B 4B 3B 5D 1B 2C 6C 8B 2C 9D 5D 8C 2D 1B 3D 5D 5C 4B 8D 7C 8B 1C 8C 5B 5C 1C 7D 3C 9D 3C 4C 6D 2C 1C 2D 7B 9C 7C 6B 4D 12 1	Drawn

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Problem C. Crazy Email Chains

Time limit: 5 seconds

It's holiday time, and you know what that means! People have stopped checking their work emails and set them to auto-reply. When a person goes on holidays and sets their auto-reply settings, their automatic response email suggests an alternate person for you to contact until they return. Of course, sometimes they are not very coordinated. One person may go on holiday and set their alternate contact to be another person who is also on holiday!

You have an urgent email to send, and need to make sure that it actually gets read by someone. If you email one person and receive an automatic response suggesting that you contact an alternate person, you will then email that alternate person, and so on until you eventually find a person that is not on holiday. But you might get stuck contacting people forever in an infinite loop if you chose to start at the wrong person!

Let's say that a person is worth contacting if contacting them, and following the chain of contacts that they recommend eventually leads to someone that is not on holiday. That is, if you get stuck emailing forever, the person is not worth contacting. We'd like to count the number of people that are worth contacting.

Input

The first line of the input contains a single integer n ($1 \le n \le 100\,000$), which is the number of people that you could contact.

The next n lines contain the information about the n people. Each of them will either contain a string of the form `name1 -> name2` indicating that the contact with the name `name1` is on holiday, and that you should contact `name2` in their place, or of the form `name is available`. It is guaranteed that the first name on each line is unique, and that all instances of `name2` correspond to one of the n names in the first column. Additionally, it is guaranteed that for lines of the first kind, `name1` and `name2` are different. Each name is nonempty and consists of at most 10 lower or upper case alphabetical characters.

The input will not contain any pair of names that differ in only their case, e.g., there will be no test cases that contain both a "Bob" and a "bob."

Output

Display the number of people that are worth contacting.

Examples

test	answer
3 Alice -> Bob Bob -> Alice Carl is available	1
3 Alice is available Bob -> Alice Carl is available	3
3 Alice -> Bob Bob -> Carl Carl -> Alice	0

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Problem D. Deconstructed Password

Time limit: 2 seconds

Bob's password contains only lowercase English letters. Many years ago, he wrote it down and put it in a shoe box. One day, Alice found the password in the shoe box and decided to play a practical joke on him. She first logged into his social media account and changed his profile to say "Alice is the most amazing person ever."

She then replaced his password in the shoe box with a sequence of integers. The sequence was constructed as follows. Let Bob's password be $s_1 s_2 \cdots s_n$. Here n is the length of Bob's password and s_i is the i-th letter of Bob's password. The sequence Alice made is $a_1, a_2, \ldots, a_n$. a_i is the first position after i where letter s_i occurs. If no such position exists, then $a_i = n+1$. That is, $a_i = \min\{j : j = n+1 \text{ or } (i < j \text{ and } s_i = s_j)\}$.

Bob has forgotten his password and has just found Alice's sequence in the shoe box. He knows how she made the sequence and he remembers that his password contained only lowercase English letters. Help Bob determine his password.

Input

The first line of input contains a single integer n ($1 \le n \le 200\,000$), which is the number of letters in Bob's password.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n+1$), which is the sequence Alice made.

Output

Display any string that could be Bob's password, given Alice's sequence. If there are multiple strings that could be Bob's password, display any of them. If it is guaranteed that Alice made a mistake generating her sequence, display -1.

Examples

test	answer
11 4 9 10 6 12 8 12 11 12 12 12	abracadabra
6 3 4 6 5 4 7	-1
7 4 6 8 8 8 8 8	perplex
10 2 5 4 6 8 9 8 10 11 11	-1

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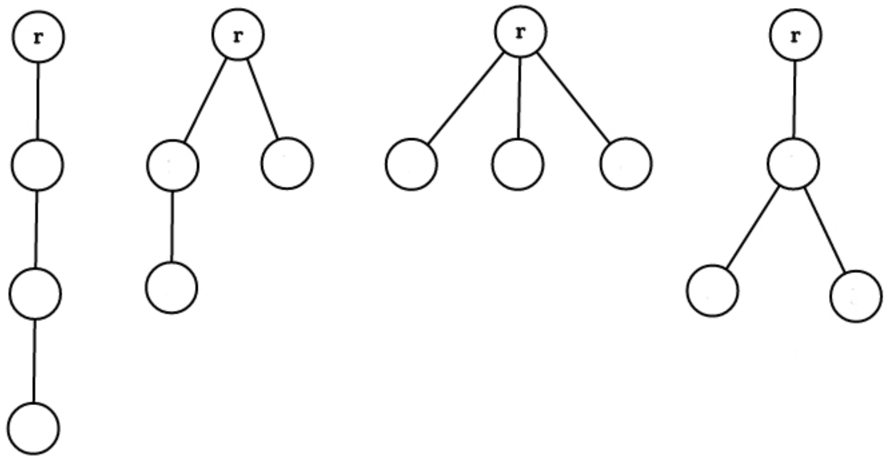
Problem E. Enumerating Trees

Time limit: 4 seconds

If a rooted tree with n vertices falls in the woods, and nobody is around to hear it, how many different trees could it be?



The four rooted trees with four vertices. Each tree's root vertex is labeled with an r.

More precisely, a rooted tree is an ordered triple (V, E, r) satisfying the following constraints:

- V and E are finite sets and $r \in V$.
- If V is of size n, then E is of size $n - 1$.
- For all $a, b \in V$, there exists a sequence $v_1, v_2, ..., v_k$ such that:
  - $v_1 = a$,
  - $v_k = b$ and
  - $\{v_i, v_{i+1}\} \in E$ for all $1 \leq i < k$.

The elements of V are vertices. The elements of E are edges, and r is the root of the tree.

Two rooted trees (V_1, E_1, r_1) and (V_2, E_2, r_2) are isomorphic if and only if there exists a function $f : V_1 \to V_2$ such that:

- f is a bijection. That is, for every $v \in V_2$, there exists a unique $u \in V_1$ such that $f(u) = v$.
- $f(r_1) = r_2$.
- For all $a, b \in V_1$, $\{a, b\} \in E_1$ if and only if $\{f(a), f(b)\} \in E_2$.

Count the number of rooted trees with n vertices. Two trees are considered different if and only if they are not isomorphic. Since this number can be very large, print it modulo the prime number p.

Input

The input consists of a single line containing two integers n $(1 \leq n \leq 1\,000)$, which is the number of vertices in each tree, and p $(10^8 \leq p \leq 10^9)$, which is the prime modulo.

Output

Display the number of different rooted trees with n vertices modulo p.

Examples

test	answer
1 100222999	1
2 100999777	1
3 100999111	2
4 100999777	4
5 100999777	9
6 100222999	20

Problem F. Fine-Tuned Resistance

Time limit: 2 seconds

The great inventor, Nikola Tesla is attempting to complete his design for the Tesla Tower that would fulfil his lifelong dream of providing free wireless power to the world. There is a final step in the process in which he requires your assistance.

Tesla needs to obtain a target resistance R using just the n resistance values available to him. For each resistance value, you may imagine that Tesla has an infinite supply of resistors of that resistance value.

There are a few rules that you have to obey:

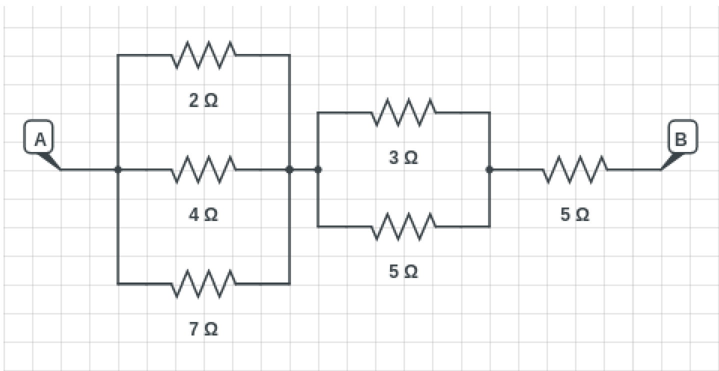
- The resistors have to be arranged in a simple resistance network, as defined below.
- At most 5 000 resistors can be used.
- The final resistance value obtained must be within 0.01 of the target resistance R.

All resistance values are given in terms of Ω.

Resistance Network

The simple resistance network required by Tesla is composed of some number of parallel networks connected in series. As an example, the simple resistance network below (between nodes A and B) comprises 3 parallel networks. The first parallel network contains 3 resistors, the second contains 2 resistors and the third contains just 1 resistor.

A parallel network must contain at least 1 resistor but the simple resistance network may be composed of 0 parallel networks, in which case the resistance of the network is 0.



Sample Output 1

Resistance Calculation

The resistance of the simple resistance network is the sum of the resistances of each parallel network.

The resistance, R' of a parallel network consisting of K resistors $(R_1, ...R_K)$ is given by the following equation:

$$\frac{1}{R'} = \sum_{i=1}^{K} \frac{1}{R_i}$$

Input

The first line of the input contains an integer n $(1 \le n \le 10)$, which is the number of different resistor values available to be used, and a real number R $(0.00 < R \le 100.00)$ specified to two digits past the decimal point, which is the target resistance value.

The second line contains n distinct integers $r_1, \ldots, r_n$ $(1 \le r_i \le 10)$ denoting the resistance values that are available.

Output

Display a valid simple resistance network whose resistance is within 0.01Ω of R (in absolute difference). Specifically, if your network produces a resistance of r, then it must be true that $|R - r| \leq 0.01$.

The first line should contain the number of parallel networks used, P. The next P lines should each specify a single parallel network. Each line should begin with the number of resistors used, K followed by K resistor values. You must only use the resistor values given (repetition allowed). The total number of resistors must not exceed 5 000.

If there are multiple solutions, any will be accepted. It is guaranteed that a solution exists.

Example

test	answer
6 8.00 2 3 4 5 7 10	3 3 2 4 7 2 3 5 1 5

Note

The resistance of the network constructed in the Sample Ouput is:

$$\frac{1}{\frac{1}{2}+\frac{1}{4}+\frac{1}{7}}+\frac{1}{\frac{1}{3}+\frac{1}{5}}+\frac{1}{\frac{1}{5}}=7.995$$