# Problem A. Who goes to visit in the morning

| | |
|---|---|
| Input file: | `a.in` |
| Output file: | `a.out` |
| Time limit: | 4 seconds |
| Memory limit: | 64 Mebibytes |

$N$ different heroes live in Amazing Forest, everyone of them has it's own house. Following the precepts of one of the most famous forest characters Winnie the Pooh, every inhabitant considers necessary to wake up early in the morning, wash itself, get dressed and go visit somebody. Certainly to act not wisely, but superwisely and not to spend much time for the road the character will go not to anybody, but to his neighbor, i.e. to the inhabitant, whose house is the closest to the one of the character's. It's not difficult to understand, that the owner of the house won't be at home, because he will also use the rule of Winnie. That's why there will be no one to scream "Hurray!", or be glad to see guests. If several houses are situated at the minimal distance to the character he will choose a house with the smallest number to visit. Your goal is to find out what characters will find themselves near each of the houses.

## Input

The first line contains the number of characters $N$ ($2 \le N \le 100000$). The each of the following $N$ lines contains two numbers – coordinates of the point in the plane, where the house of certain character is situated. All coordinates are not negative and do not exceed $10^9$.

## Output

Output $N$ lines. $i$-line has to contain number $i$, which are followed by colon and then the numbers of characters, who will come to $i$-house in ascending order.

## Example

| a.in | a.out |
|---|---|
| 6<br>0 0<br>1 0<br>0 1<br>3 3<br>2 2<br>3 1 | 1: 2 3<br>2: 1<br>3:<br>4: 5<br>5: 4 6<br>6: |

# Problem B. Prince or impostor

| | |
|---|---|
| Input file: | `b.in` |
| Output file: | `b.out` |
| Time limit: | 4 seconds |
| Memory limit: | 64 Mebibytes |

In ancient times and past centuries the great king Darius was in Persia. The country was developed and everything was enough. One beautiful day the king's son was born, and there were no happier person in the world, than Darius. He made a great celebration in honor of this event. But while the celebration was held, the assassins hired by enemies of Darius got to the bedchamber and stole the baby. Darius became very angry and ordered to put the guard to death. besides that he ordered to announce search and promised a huge reward to the man, who would find and get the prince back to the palace...

...Days passed, weeks, months and years passed, but there were no news about the son. And when the eighteenth year of searches was, a tall young man with a spark in his eyes came to the palace and said he was that missing prince. Enormous histories were told by the young man. About his being flipped to the other family of a simple fisher, which under pain of death was denied to speak about the prince to anybody, about how he lived all those years, about the fisher revealing a terrible secret about his origins.

Darius was ready to believe the young man and take him into the arms, but the vizier advised the king not to hurry and make a check at first. It is known that every cell of a body contains DNA, which is a chain of nucleotides, which are coded by characters `A`, `G`, `T`, `C`, and the chains of relatives must be alike. Vizier offered to take some fragment of young man's DNA and compare to those of the king, starting from some position. Of course the best case is when a fragment would be found at the chosen position. Generally speaking the mere of similarity would be the number of coincidences while comparing the corresponding elements. Vizier and the king ask you to find out the position, from which one should begin the comparison to achieve the biggest similarity degree.

## Input

The first line contains king's DNA – consequence of characters `A`, `G`, `T`, `C`. The second line contains the same for the young man. The lengths of lines do not exceed 200000 and the second line's length does not exceed the first one's.

## Output

Output the position, from which one should begin the comparison to achieve the biggest similarity. If there are several such positions output the first of them. The positions are numerated from 1.

## Note

Take into account that every symbol of the second line is corresponded to some symbol from the first line. In other words, when placing the second line from the necessary position it will not go beyond the first one.

## Examples

| b.in | b.out |
|---|---|
| AGTCAGTC<br>GTC | 2 |
| AAGGTTCC<br>TCAA | 5 |

# Problem C. What? Where? When?

| | |
|---|---|
| Input file: | `c.in` |
| Output file: | `c.out` |
| Time limit: | 1 second |
| Memory limit: | 64 Mebibytes |

"Dear informatic experts"! In famous TV show "What? Where? When?" experts' team plays against team of televiewers, who send their questions to the programme. Letters with the questions are put to the round playtable, which is divided to the $N$ equal sectors – each letter to the each sector. At the center of the table top arrow is placed. Each round starts with the spinning of the arrow by Managing Hall When the arrow is stopped the question from the sector, where the arrow has stoped the question which experts should answered after a minute of discussing is taken. If the question from the sector, where the arrow has stopped, has played in the one of the previous rounds, the next clockwise question is taken. Frankly speaking, the game lasts to the time, when the one of the teams specified number of scores reach, but we will think that the game ends when no questions are left on the table.

Lets thought that some rounds have passed and questions from some secors has played. "Attention. And so is question."! (gong bang!)

In a one secoond time your programme should answered, what is probability that in $k$ round (starts with current one) will play te question which is in $i$ sector. Of course all sectors are the same, so the probability to stop of the arrow in each of them we will take the same.

## Input

At the first line given three integers $N$, $i$, $k$ ($1 \le i \le N \le 20$, $1 \le k \le N$). At the second one given $N$ integers, each of them equal 0, or 1. The 0 value means, that the question from the corresponding sector has played in the one of the previous rounds, 1 means that the question is still on the table.

## Output

Output the probability that the question from the $i$ sector will play after $k$ spinning of the arrow whith preception not less then $10^{-8}$.

## Examples

| c.in | c.out |
|---|---|
| 10 5 1<br>1 1 1 1 1 1 1 1 1 1 | 0.1 |
| 4 2 2<br>0 1 1 0 | 0.25 |

# Problem D. Tiling

| | |
|---|---|
| Input file: | `d.in` |
| Output file: | `d.out` |
| Time limit: | 1 second |
| Memory limit: | 64 Mebibytes |

The famous developer Peter again starts writing new computer game at the platformer style. At one level, he has a corridor, divided into $N$ equal parts. This corridor should be covered with a tiles. Each tile can be any length and so they can cover several successive sections. It i needed to stow tiles so that each section was covered by a given number of tiles. Help Peter count what is the minimum number of tiles, which he needed to do this.

## Input

At the The first line is given an integer $N$ ($1 \le N \le 200000$) - length of the corridor. The second line contains $N$ integers, each of which determines the number of tiles that must be met corresponding site. All numbers are nonnegative and do not exceed $10^9$.

## Output

Output the minimum number of tiles, which is need for covering. S

## Examples

| d.in | d.out |
|---|---|
| 3<br>3 4 1 | 4 |
| 3<br>4 1 3 | 6 |

# Problem E. Passage Corridor

| | |
|---|---|
| Input file: | `e.in` |
| Output file: | `e.out` |
| Time limit: | 1 second |
| Memory limit: | 64 Mebibytes |

As we already know, the Peter's game has a corridor, divided into $N$ sites. Assume that each of the sites covered by some number of individual tiles. Character in the game, runned by a player, located in the beginning of the corridor before the first site and may pass on to this area, having spent a single move. If it was at least one tile at the site, then after passing through the section one tile disappears. Thus the number of tiles is reduced by 1. If at the site was no tiles, the character dies, respectively, the player loses one life, then at this site $K$ new tiles appeared, and the player has a new character in the beginning of the corridor. If a player has successfully passed the site and was not killed, he faces the following site that he can go if it has at least one plate, or die if no plates aree there. In any case it require one move. It is allowed to move forward only. It is believed that the player has passed the corridor, if his character in some time will be at the end of the corridor, thqt means that he passed the last tile and do not die on it. Help the player to know how many need lives and moves for the passage of the corridor.

## Input

At the first row two integers $N$ and $K$ ($1 \leq N \leq 10000$, $1 \leq K \leq 100$) the length of the corridor and the number appearing after the loss of character tiles on the site are given. The second line contains $N$ integers, each of which determines the number of tiles, which originally covered with an appropriate site. These numbers can take values from 0 to $K$ inclusive.

## Output

Output the number of lives the player lose and the number of moves before the plalyer reaches finish

## Examples

| e.in | e.out |
|---|---|
| 3 3<br>2 2 2 | 0 3 |
| 4 2<br>1 0 2 1 | 2 7 |
| 5 1<br>0 0 0 0 0 | 31 62 |

# Problem F. The Game

| | |
|---|---|
| Input file: | `f.in` |
| Output file: | `f.out` |
| Time limit: | 1 second |
| Memory limit: | 64 Mebibytes |

Two players play the following game. On the table $N$ heaps of stones are, $i$-th heap contains $n_i$ stones at the beginning, in addition natural numbers $x_i$ and $y_i$ assigned to her. Players take turns. In one move, the player chooses some heap. Let her number $i$. Then he can take out of it either $x_i$, or $y_i$ stones. The move can be made if the heap contains no less stones than the player is going to take from it. Someone lose when he can not make a move. Determine who will win in the regular game: a player who goes first, or a player who goes second.

## Input

The first line of the input file contains a positive integer $N \le 10000$. The following $N$ rows contain 3 numbers each. $i$-th row contains the parameters $i$-th row: $n_i$, $x_i$, $y_i$. And, $1 \le n_i$, $x_i$, $y_i \le 10^{18}$.

## Output

In a single line of output file output " First" (without the quotes), if win the first player, and " Second" (without the quotes) otherwise.

## Examples

| f.in | f.out |
|---|---|
| 4<br>3 1 2<br>1 2 3<br>4 1 1<br>10 3 5 | Second |

# Problem G. Hamilton Cycle

| | |
|---|---|
| Input file: | `g.in` |
| Output file: | `g.out` |
| Time limit: | 1 second |
| Memory limit: | 64 Mebibytes |

One day, Earl William Hamilton decided to travel around the world, in travel he would visit $N$ largest cities of the earth. Between all pairs of cities there are roads. Every road leading from one city to another, Earl Hamilton assigns a certain number (entertainment), which is a power of 2. Since the two sides of one road landscapes are different, entertainment road when driving through it in one direction is different from entertainment when driving in the other direction. Moreover, it appears that all roads have different entertainment. Earl wants to choose a closed path (beginning and ending in the same town), passing through all the cities one by one once and having a maximum total entertainment. Find the best closed the route for the Count of Hamilton. Earl lives in a city with the number 1.

## Input

The first line is given an integer $N$ — the number of cities ($2 \leq N \leq 500$). In each of the following $N$ rows $N$ numbers is given. If $j$-th number in the $i$-th row is equal to $c_{ij}$, then the spectacle of the road from the city of $i$ in city $j$ is $2^{c_{ij}}$. All the numbers $c_{ij}$ ($i \neq j$) distinct and are range from 0 to $10^6$ inclusive. The values of $c_{ii}$ are also given equal to $-1$, which means that the road from the city $i$ is not passing through the other city, does not exist

## Output

Display the number of cities in the order in which the Earl Hamilton should visit them so his route has the most entertainment. Graph should start their journey from the city 1 and finish in it. In the case if there are multiple optimal routes, you can derive any of them.

## Examples

| g.in | g.out |
|---|---|
| 3<br>-1 5 1<br>4 -1 2<br>6 0 -1 | 1 2 3 1 |

# Problem H. Very freindly group

| | |
|---|---|
| Input file: | `h.in` |
| Output file: | `h.out` |
| Time limit: | 2 seconds |
| Memory limit: | 64 Mebibytes |

There are $N$ girls and $M$ boys in the class. Class teacher Snezhana Denisovna must select a group of $L$ girls and $K$ boys, on the representation of the class. This group should be very friendly, so each boy has chosen friends with each selected girl. Snezhana Denisovna interested in all ways to do this, then it will pick the best of them from her point of view. Help it and find the total number of ways to form a very tight-knit group of children. So as the answer may be very large output it at modulo 1000000007.

## Input

At the first line of the input file the positive integers $N, M, L, K$ are given. In this case, $L \leq N \leq 100000$ and $K \leq M \leq 15$. The following $N$ rows contain $M$ symbols 0 or 1 each. In this case, $j$-th symbol $i$-th row equal to 1 if only when $i$-th girl friend of the $j$-th boy.

## Output

In a single line of output file output the answer to the problem.

## Examples

| h.in | h.out |
|---|---|
| 4 3 1 1<br>111<br>101<br>110<br>010 | 8 |
| 4 3 2 1<br>111<br>101<br>110<br>010 | 7 |

# Problem I. Trees with an odd number of independent sets

| | |
|---|---|
| Input file: | `i.in` |
| Output file: | `i.out` |
| Time limit: | 3 seconds |
| Memory limit: | 64 Mebibytes |

You are given a positive integer $n \leq 1000$ and a prime $p$ ($10^7 < p < 10^9$). Find the number of rooted trees with $n$ vertices with unlabelled vertices with an odd number of independent sets. Result output on modulo $p$.

The tree is called the **root with unmarked vertices**, if any OF its top is fixed as the root and the order of the sons of any vertex not important. That is, two trees are considered equal if they coincide after some reordering of non-root vertices. Quite a formal definition: two root of a tree with unlabelled vertices $T_1$ and $T_2$ are equal if there is a bijection $f$ from the set of vertices of the tree $T_1$ on the set of vertices of the tree $T_2$, which takes the root $T_1$ to the root of $T_2$ and for any edge $(u, v)$ from $T_1$ in $T_2$ is an edge $(f(u), f(v))$.

A set of vertices (possibly empty) is called **independent** if no two vertices of this set is connected edge.

## Input

In a single line of input file specified number of $n$ and $p$.

## Output

In a single line of output file output the answer to the problem.

## Examples

| i.in | i.out |
|---|---|
| 1 176531359 | 0 |
| 2 896663687 | 1 |
| 3 793877167 | 2 |
| 51 120107707 | 114046817 |

# Problem J. Maximal power of prime

| | |
|---|---|
| Input file: | `j.in` |
| Output file: | `j.out` |
| Time limit: | 5 seconds |
| Memory limit: | 64 Mebibytes |

You are given a positive integer $n > 1$. Consider all the different prime divisors $n$. Each of them is included in the expansion $n$ into prime factors in some degree. Required to find among the indicators of these powers is maximal.

## Input

The first line of the input file is given a positive integer $T \leq 500$, number of positive integers $n$ in the file. In the next $T$ line sets these numbers themselves. It is guaranteed that each of them does not exceed $10^{18}$.

## Output

For each positive integer $n$ from an input file output in a separate line a maximum degree of occurrence of a prime in the decomposition of $n$ into simple factors.

## Examples

| j.in | j.out |
|---|---|
| 5<br>2<br>12<br>108<br>36<br>65536 | 1<br>2<br>3<br>2<br>16 |

# Problem K. Minimal power of prime

| | |
|---|---|
| Input file: | `k.in` |
| Output file: | `k.out` |
| Time limit: | 8 seconds |
| Memory limit: | 64 Mebibytes |

You are given a positive integer $n > 1$. Consider all the different prime divisors $n$. Each of them is included in the expansion $n$ into prime factors in some degree. Required to find among the indicators of these powers is minimal.

## Input

The first line of the input file is given a positive integer $T \leq 100000$, number of positive integers $n$ in the file. In the next $T$ line sets these numbers themselves. It is guaranteed that each of them does not exceed $10^{18}$.

## Output

For each positive integer $n$ from an input file output in a separate line a minimum degree of occurrence of a prime in the decomposition of $n$ into simple factors.

## Examples

| k.in | k.out |
|---|---|
| 5<br>2<br>12<br>108<br>36<br>65536 | 1<br>1<br>2<br>2<br>16 |