Problem A. GPA

Description

In college, a student may take several courses. for each course i, he earns a certain credit (c_i), and a mark ranging from A to F, which is comparable to a score (s_i), according to the following conversion table

A	A-	B+	B	B-	C+	C	C-	D	D-	F
4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	0

The GPA is the weighted average score of all courses one student may take, if we treat the credit as the weight. In other words,

$$GPA = \frac{\sum (c_i * s_i)}{\sum c_i}$$

An additional treatment is taken for special cases. Some courses are based on "Pass/Not pass" policy, where students earn a mark "P" for "Pass" and a mark "N" for "Not pass". Such courses are not supposed to be considered in computation. These special courses must be ignored for computing the correct GPA.

Specially, if a student's credit in GPA computation is 0, his/her GPA will be "0.00".

Input

There are several test cases, please process till EOF.

Each test case starts with a line containing one integer N ($1 \le N \le 1000$), the number of courses. Then follows N lines, each consisting the credit and the mark of one course. Credit is a positive integer and less than 10.

Output

For each test case, print the GPA (rounded to two decimal places) as the answer.

Samples

Sample Input	Sample Output
5 2 B 3 D- 2 P 1 F 3 A 2 2 P 2 N 6 4 A 3 A 3 A 4 A 3 A 3 A	2.33 0.00 4.00

For the first test case:

$$GPA = \frac{3.0 * 2 + 1.0 * 3 + 0.0 * 1 + 4.0 * 3}{2 + 3 + 1 + 3} = 2.33$$

For the second test case: because credit in GPA computation is 0(P/N in additional treatment), so his/her GPA is “0.00”.

Problem B. Poor Warehouse Keeper

Description

Jenny is a warehouse keeper. He writes down the entry records everyday. The record is shown on a screen, as follow:

Number	2	+
Total prices	5	+

There are only two buttons on the screen. Pressing the button in the first line once increases the number on the first line by 1. The cost per unit remains untouched. For the screen above, after the button in the first line is pressed, the screen will be:

Number	3	+
Total prices	7	+

The exact total price is 7.5, but on the screen, only the integral part 7 is shown.

Pressing the button in the second line once increases the number on the second line by 1. The number in the first line remains untouched. For the screen above, after the button in the second line is pressed, the screen will be:

Number	3	+
Total prices	8	+

Remember the exact total price is 8.5, but on the screen, only the integral part 8 is shown.

A new record will be like the following:

Number	1	+
Total prices	1	+

At that moment, the total price is exact 1.0.

Jenny expects a final screen in form of:

Number	x	+
Total prices	y	+

Where x and y are previously given.

What's the minimal number of pressing of buttons Jenny needs to achieve his goal?

Input

There are several (about $50,000$) test cases, please process till EOF.

Each test case contains one line with two integers $x(1 \le x \le 10)$ and $y(1 \le y \le 10^9)$ separated by a single space - the expected number shown on the screen in the end.

Output

For each test case, print the minimal number of pressing of the buttons, or "-1"(without quotes) if there's no way to achieve his goal.

Samples

Sample Input	Sample Output
1 1 3 8 9 31	0 5 11

For the second test case, one way to achieve is:

$(1,1) \rightarrow (1,2) \rightarrow (2,4) \rightarrow (2,5) \rightarrow (3,7.5) \rightarrow (3,8.5)$

Problem C. Campus Design

Description

Nanjing University of Science and Technology is celebrating its 60th anniversary. In order to make room for student activities, to make the university a more pleasant place for learning, and to beautify the campus, the college administrator decided to start construction on an open space.

The designers measured the open space and came to a conclusion that the open space is a rectangle with a length of n meters and a width of m meters. Then they split the open space into $n \times m$ squares. To make it more beautiful, the designer decides to cover the open space with 1×1 bricks and 1×2 bricks, according to the following rules:

1. All the bricks can be placed horizontally or vertically
2. The vertexes of the bricks should be placed on integer lattice points
3. The number of 1×1 bricks shouldn't be less than C or more than D. The number of 1×2 bricks is unlimited.
4. Some squares have a flowerbed on it, so it should not be covered by any brick. (We use 0 to represent a square with flowerbed and 1 to represent other squares)

Now the designers want to know how many ways are there to cover the open space, meeting the above requirements.

Input

There are several test cases, please process till EOF.

Each test case starts with a line containing four integers $N(1 \leq N \leq 100)$, $M(1 \leq M \leq 10)$, C, $D(1 \leq C \leq D \leq 20)$. Then following N lines, each being a string with the length of M. The string consists of '0' and '1' only, where '0' means the square should not be covered by any brick, and '1' otherwise.

Output

Please print one line per test case. Each line should contain an integers representing the answer to the problem (mod $10^9 + 7$).

Samples

Sample Input	Sample Output
1 1 0 0	0
1	0
1 1 1 2	1
0	1
1 1 1 2	1
1	2
1 2 1 2	1
11	0
1 2 0 2	2
01	954
1 2 0 2	
11	
2 2 0 0	
10	
10	
2 2 0 0	
01	
10	
2 2 0 0	
11	
11	
4 5 3 5	
11111	
11011	
10101	
11111	

Problem D. Shoot

Description

At the year of 8192, the war between Evil Army and Galaxy Army broken out. Unfortunately, Evil Army had conquered half the galaxy in just one year. To prevent the situation of the war from getting worse, Levi, the general of Galaxy Elite Army, was ordered by his superior to attack the enemy's power bases.

Levi was born with the remarkable ability of counter-surveillance, it was just a piece of cake for him to reach Evil Army's power bases. Each power base can be represented as a triangle in 3D-Cartesian coordinate system. The only weapon Levi had was a laser cannon which can shoot in **both two directions simultaneously**. To avoid being caught by enemy, Levi can only place the laser cannon somewhere on a segment from S to T. Unfortunately, there was something wrong with the laser cannon, Levi can't adjust its shooting angle, so the shooting direction was fixed.

Since Levi didn't have any time to find the best place to shoot the laser, he decided to select a point on the segment randomly to place the cannon. If the laser touched the base(even the boundary), the base will be destroyed. Your task is to calculate the expected number of the destroyed bases in just one shoot.

It is recommended to see the sample input to understand the problem statement more clearly.

Input

There are several test cases, please process till EOF.

For each test case, the first line is an integer N ($1 \leq N \leq 100000$), the number of enemy's power bases. Each of the next three lines contains 3 integers, x, y, z, denoting the coordinates of S, T, and the fixed shooting direction. The last N lines contains 9 integers, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, denoting the coordinates of the three vertices of enemy's power base. It is guaranteed that all the triangles will not degenerate.

And the absolute value of all numbers except N will not exceed 1000.

Output

For each test case, print the expected number of destroyed power bases.

Any answer within an absolute error less than or equal to 10^{-6} would be accepted.

Samples

Sample Input	Sample Output
2 0 0 0 2 0 0 0 0 1 -1 0 1 1 0 1 -1 0 2 1 1 -1 1 -1 -1 2 0 -1	1.00000000

Problem E. Circular Lamps

Description

The circular roundabout of 2nd road is an important traffic junction in Nanjing University of Science and Technology. To celebrate the 60th anniversary, the school officer decides to build some lamps with digital shape surrounding the circular roundabout.

There are $2N$ lamps to build. Lamps have the shape of digits, ranging from 1 to $2N$. Specially, lamps will be built as a whole which can't be split into single numbers. For example, lamp 19 can't be split into lamp 1 and lamp 9. Since the roundabout is circular, the last lamp is next to the first lamp. Unfortunately, due to the carelessness of the construction team, some lamps are placed in the wrong position. Since the construction team is now absent after finishing their work, we could only correct the order of lamps by ourselves. After rearrangement, the lamp with the shape i ($1 \leq i \leq 2N$) is expected to be placed on the i-th position. In other words, the final permutation should be $1, 2, \ldots, 2N$. Because of the large volume of the lamps, we have only two ways to adjust the order

1) Reverse the consecutive 4 lamps starting from the position x, denotes as $(1\ x)$. For example:

   `(1 4): 1 2 3 [4 5 6 7] 8` $\rightarrow$ `1 2 3 [7 6 5 4] 8`

   or

   `(1 6): 1] 2 3 4 5 [6 7 8` $\rightarrow$ `6] 2 3 4 5 [1 8 7`

   where '`[`' stands for the start position, and '`]`' stands for the end position respectively.

2) Shift all lamps to the left by x positions, denotes as $(2\ x)$. For example:

   `(2 4): 1 2 3 4 5 6 7 8` $\rightarrow$ `5 6 7 8 1 2 3 4`

   or

   `(2 7): 1 2 3 4 5 6 7 8` $\rightarrow$ `8 1 2 3 4 5 6 7`

The data guarantees the existence of a valid adjustment sequence. Also the case where all lamps are already placed correctly will not exist in the input.

Your task is to generate a valid adjustment sequence that all lamps are put on the correct position.

Input

There are several test cases, please process till EOF.

Each test case starts with a line containing one integers $N (2 \leq N \leq 30)$. The next line contains $2N$ different integers, the i-th number A_i denotes that the shape of the i-th lamp is $A_i (1 \leq A_i \leq 2N)$.

Output

For each test case, the first line of the output should contain a single integer $S \leq 400000$, denoting the number of swap operations you need to perform.

Each of the following S lines should consist of two integers. The first one may be 1 or 2, indicating the type of swap operations. For the first type, the second number is the start position of the operation, and for the second type, the second number is the positions you need to shift. In both cases, the second number should be ranged between 1 and $2N$.

If there are multiple possible solutions satisfying the conditions above, any one will be accepted. Please don't print extra empty lines, spaces and other irrelevant characters.

Samples

Sample Input	Sample Output
4 6 5 4 3 2 1 8 7 4 4 5 1 2 3 6 7 8 4 7 8 4 3 2 1 5 6	2 1 2 1 6 2 1 2 1 1 2 1 3 2 2

Problem F. Lunch Time

Description

The campus of Nanjing University of Science and Technology can be viewed as a graph with N vertexes and M directed edges (vertexes are numbered from 0 to $N-1$). Each edge has the same length 1. Every day, there are K students walking to the dinning-hall (vertex $N-1$) from the teaching building (vertex 0) at lunch time. They all want reach the dinning-hall as soon as possible. However, each edge can only serve at most c_i students at any time. Can you make arrangements for students, so that the last student can reach the dinning-hall as soon as possible? (It is assumed that the speed of the students is 1 edge per unit time)

Input

There are several test cases, please process till EOF.

The first line of each test case contains three integer $N(2 \le N \le 2500)$, $M(0 \le M \le 5000)$, $K(0 \le K \le 10^9)$. Then follows M lines, each line has three numbers a_i, b_i, $c_i(0 \le c_i \le 20)$, means there is an edge from vertex a_i to b_i with the capacity c_i.

Output

For each test case, print an integer represents the minimum time. If the requirements can not be met, print "No solution"(without quotes) instead.

Samples

Sample Input	Sample Output

<pre>5 6 4
0 1 2
0 3 1
1 2 1
2 3 1
1 4 1
3 4 2
3 3 10
0 1 1
1 2 1
0 2 1
2 0 1</pre>
	<pre>3
	6
	No solution</pre>

Problem G. Drunk

Description

Jenny is seriously drunk. He feels as if he is in an N-dimension Euclidean space, wandering aimlessly. In each step, he walks toward some direction and the "length" of each step will not exceed R. Technically speaking, Jenny is initially located at the origin of the N-dimension Euclidean space. Each step can be represented by a random N-dimension vector$(x_1, x_2, \ldots, x_n)$ chosen uniformly from possible positions satisfying $x_i \geq 0$ and $x_1^2 + x_2^2 + \cdots \leq R^2$.

Assume the expectation of his coordinate after his first step is $(y_1, y_2, \ldots, y_n)$. He wants to know the minimum y_i .

Input

There are several (about $10,000$) test cases, please process till EOF.

Each test case, only one line contains two integers N and R, representing the dimension of the space and the length limit of each step.($1 \leq n \leq 2 \times 10^5$, $R \leq 10^5$)

Output

For each test case, print a real number representing the answer to the question above.

Your answer is considered correct if the difference between your answer and the correct one is less than 10^{-6}.

Samples

Sample Input	Sample Output
`2 1`	`0.4244131816`

Problem H. Cirno's Present

Description

One day, three fairies, Sunny, Luna and Star visited Cirno's house. Cirno was very happy, so she decided to give a present to them.

Cirno's present was a tree with N nodes. Each node of the tree has an equal possibility to be owned by one of Sunny, Luna or Star. After having decided every node's owner, Cirno cut the edges that connect different owner's nodes, after which each of the three fairies got some connected component of nodes (possibly none).

Then each of the three fairies had to spend some magical energy repairing the components she got. Suppose she had X components containing odd number of nodes and Y components containing even number of nodes, the magical energy she would spend equals $\max(0, X - Y)$.

Cirno would compensate for the energy they spent with some food, so she asked you the expectation of the **total** energy the three fairies would spend, and your task is to find out the answer.

To make it simpler, as it's easy to prove the multiplication of the expectation and the Nth power of three makes an integer, your task is to find the remainder of the multiplication divided by $10^9 + 7$.

Input

There are several test cases, please process till EOF.

Each test case starts with a line containing one integer N ($1 \le N \le 300$). Then follows $N - 1$ lines, each contains two integers u and v ($1 \le u, v \le N$), representing an edge between node u and node v.

Output

For each test case, print the remainder of the product of the expected energy cost and the N-th power of three (actually, the remainder divided by $10^9 + 7$) in a line.

Samples

Sample Input	Sample Output
1 2 1 2 3 2 1 1 3	3 12 51

Problem I. Wall Painting

Description

Ms.Fang loves painting very much. She paints GFW(Great Funny Wall) every day. Every day before painting, she produces a wonderful color of pigments by mixing water and some bags of pigments. On the K-th day, she will select K specific bags of pigments and mix them to get a color of pigments which she will use that day. When she mixes a bag of pigments with color A and a bag of pigments with color B, she will get pigments with color A xor B. When she mixes two bags of pigments with the same color, she will get color zero for some strange reasons. Now, her husband Mr.Fang has no idea about which K bags of pigments Ms.Fang will select on the K-th day. He wonders the sum of the colors Ms.Fang will get with $\binom{N}{K}$ different plans.

For example, assume $n = 3$, $K = 2$ and three bags of pigments with color $2, 1, 2$. She can get color $3, 3, 0$ with 3 different plans. In this instance, the answer Mr.Fang wants to get on the second day is $3 + 3 + 0 = 6$.

Mr.Fang is so busy that he doesn't want to spend too much time on it. Can you help him? You should tell Mr.Fang the answer from the first day to the n-th day.

Input

There are several test cases, please process till EOF.

For each test case, the first line contains a single integer $N(1 \le N \le 10^3)$.The second line contains N integers. The i-th integer (not exceed 10^9) represents the color of the pigments in the i-th bag.

Output

For each test case, output N integers in a line representing the answers(mod $10^6 + 3$) from the first day to the n-th day.

Samples

Sample Input	Sample Output
4 1 2 10 1	14 36 30 8

Problem J. Ball

Description

Jenny likes balls. He has some balls and he wants to arrange them in a row on the table. Each of those balls can be one of three possible colors: red, yellow, or blue. More precisely, Jenny has R red balls, Y yellow balls and B blue balls. He may put these balls in any order on the table, one after another. Each time Jenny places a new ball on the table, he may insert it somewhere in the middle (or at one end) of the already-placed row of balls.

Additionally, each time Jenny places a ball on the table, he scores some points (possibly zero). The number of points is calculated as follows:

- For the first ball being placed on the table, he scores 0 point.
- If he places the ball at one end of the row, the number of points he scores equals to the number of different colors of the already-placed balls (i.e. expect the current one) on the table.
- If he places the ball between two balls, the number of points he scores equals to the number of different colors of the balls before the currently placed ball, plus the number of different colors of the balls after the current one.

What's the maximal total number of points that Jenny can earn by placing the balls on the table?

Input

There are several test cases, please process till EOF.

Each test case contains only one line with 3 integers R, Y and B, separated by single spaces. All numbers in input are non-negative and won't exceed 10^9.

Output

For each test case, print the answer in one line.

Samples

Sample Input	Sample Output
2 2 2 3 3 3 4 4 4	15 33 51

Problem K. D Tree

Description

There is a skyscraping tree standing on the playground of Nanjing University of Science and Technology. On each branch of the tree is an integer (The tree can be treated as a connected graph with N vertices, while each branch can be treated as a vertex). Today the students under the tree are considering a problem: Can we find such a chain on the tree so that the multiplication of all integers on the chain (mod $10^6 + 3$) equals to K?

Can you help them in solving this problem?

Input

There are several test cases, please process till EOF.

Each test case starts with a line containing two integers $N(1 \leq N \leq 10^5)$ and K$(0 \leq K < 10^6 + 3)$. The following line contains n numbers $v_i(1 \leq v_i < 10^6 + 3)$, where v_i indicates the integer on vertex i. Then follows $N - 1$ lines. Each line contains two integers x and y, representing an undirected edge between vertex x and vertex y.

Output

For each test case, print a single line containing two integers a and b (where $a < b$), representing the two endpoints of the chain. If multiply solutions exist, please print the lexicographically smallest one. In case no solution exists, print "No solution"(without quotes) instead.

For more information, please refer to the Sample Output below.

Samples

Sample Input	Sample Output
5 60 2 5 2 3 3 1 2 1 3 2 4 2 5 5 2 2 5 2 3 3 1 2 1 3 2 4 2 5	3 4 No solution