Problem A : Tax

The amount of income tax imposed on any taxpayer depends on his/her income. For an income less than or equal to 1,000,000 Oshloobs, no tax is paid. For an income greater than 1,000,000 and less than or equal to 5,000,000 Oshloobs, the tax is 10% of the income. For an income over 5,000,000 Oshloobs, the tax is 20% of the income. You should write a program to calculate the net income of any given employee after the deducted tax.

Input (Standard Input)

There are multiple lines in the input. Each line contains an employee's income before the tax, which is a positive integer, a multiple of 1000, and not greater than 10,000,000. The input terminates with a line containing `0` which should not be processed.

Output (Standard Output)

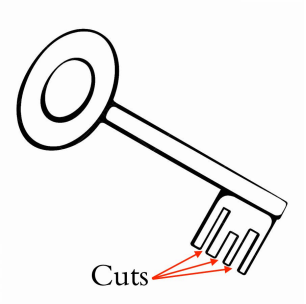
For each employee, output a line containing the net income after the deducted tax.

Sample Input and Output

Standard Input	Standard Output
10000 50000 2000000 7500000 0	10000 50000 1800000 6000000

Problem B : Key Maker

Hassan is a happy key maker. Every customer arrives with a safe-box key, and asks him to create some copies of the key. Each key has several cuts of different depths. The picture below shows a safe-box key with 3 cuts. To make a copy, Hassan needs to make the same number of cuts with exactly the same sequence of depths in a new blank key.



In the first days of his job, Hassan wasted many blank keys to make copies. Most of the copied keys, however, did not match the customer keys and he could not sell them. He collected those copied keys in a trash-box, and now he is thinking of recycling them.

When a new customer arrives, Hassan looks into the trash-box, collects all keys with the same number of cuts as the customer's key, and counts the keys that can match the customer's key. A key can match the customer's key if it already has exactly the same sequence of cut depths, or the depth of some of its cuts can be increased to reach the same sequence. Since this job is too hard for him, he has asked your help. For simplicity, you can assume that in any two keys with the same number of cuts, the position of the cuts along the keys are identical.

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains two space-separated integers m as the number of cuts in the customer's key ($1 \leqslant m \leqslant 10$), and n as the number of keys with the same number of cuts in the trash-box ($1 \leqslant n \leqslant 100$). The second line of the test case consists of m space-separated integers, as the depths of cuts in the customer's key. Each of the next n lines also contains m integers, as the depths of cuts in a trash-box key. The depth of cuts in each of these $n + 1$ keys are 1-digit positive integers given in the left-to-right order. The input terminates with a line containing `0 0` which should not be processed.

Output (Standard Output)

For each test case, print a single line containing the number of keys in the trash-box that either match the customer's key or can be cut to match it.

Sample Input and Output

Standard Input	Standard Output
4 1 3 2 1 3 2 2 1 2 4 1 4 2 2 2 3 2 2 3 5 3 2 2 4 2 2 2 3 4 3 2 1 1 3 2 2 2 2 2 2 2 0 0	1 0 2

Problem C : IOI 2017 Logo

Iran is the host of the International Olympiad in Informatics (IOI) 2017. In order to design the IOI 2017 logo, the organizing committee of the IOI 2017 decided to publicly call for logos. It was not surprising that many logos were received in a short time as the young generation in Iran is actively taking part in any national event. In the first round, logos were judged by some professional graphic designers, and the best logos being artistically capable to be the IOI 2017 logo were selected to be judged in the second round.

The selected logos are now presented to the organizing-committee members for voting. The voting system is a little bit complicated: each member can vote for at most three different logos in some order. The first, second and third choices of each member are awarded 3, 2 and 1 points, respectively. The score of a logo is the total points the logo receives from all members. The logo with the highest score is the winner. In the case of ties, the winner is the logo with higher number of first votes. Again, if some logos have the same score and first votes, the logo with more second votes is the winner. If we still have ties, all of them would be winners. Given the voting information, your job is to identify the winner logo (or logos).

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains a positive integer n denoting the number of voters ($1 \leqslant n \leqslant 100$). Each of the next n lines starts with an integer d_i, representing the number of logos chosen by the i-th voter ($1 \leqslant d_i \leqslant 3$), followed by d_i different logo IDs showing the choices of that voter (from left to right). Each logo ID is a positive integer not exceeding 10^6. All integers in a line are separated with a single space. The input terminates with a line containing 0 which should not be processed.

Output (Standard Output)

For each test case, output a line containing the winner logos in the increasing order of their IDs. Logo IDs in a line must be separated with a single space.

Sample Input and Output

Standard Input	Standard Output
4 3 5 2 1 3 12 5 2 2 1 2 3 2 1 5 2 3 3 2 1 3 2 3 1 0	2 2 3

Problem D : MicroRNA Ranking

Ahlaam is a computer science student, doing her master thesis on a bioinformatics project about MicroRNAs, special molecule types found in cells. During her thesis, she wants to find microRNAs relevant to a specific health factor in human beings.

Ahlaam has designed k microRNA ranking algorithms, each of which ranks microRNAs from a specific point of view. There are n microRNAs numbered 1 through n, and each algorithm produces one permutation of these n microRNAs. In the permutation produced by each algorithm, the first microRNA is inferred by the algorithm as the most relevant one to the health factor, and the last microRNA is inferred as the least relevant one.

Ahlaam wants to report a *consensus* ranking on microRNAs. In a consensus ranking, if microRNA i is ranked before another mircroRNA j, then at least half of the algorithms should have ranked i before j. Write a program to help Ahlaam find a consensus ranking.

Input (Standard Input)

There are multiple test cases in the input. The first line of each test contains two space-separated integers n ($1 \leqslant n \leqslant 1000$) and k ($1 \leqslant k \leqslant 200$), the number of microRNAs and the number of ranking algorithms, respectively. Then, there are k lines, where the i-th line contains a permutation of n numbers $1, \ldots, n$, representing the output of the i-th ranking algorithm. The input terminates with a line containing `0 0` which should not be processed.

Output (Standard Output)

For each test case, print a single line containing a permutation of n numbers $1, \ldots, n$, representing a possible consensus ranking. If there are more than one correct consensus rankings, print the first one in lexicographic order (a sequence $a_1, \cdots, a_n$ is lexicographically less than a sequence $b_1, \cdots, b_n$ iff there exists a positive integer j such that $a_i = b_i$ for all $1 \leqslant i \leqslant j-1$ and $a_j < b_j$) . If no such a ranking exists, write "`No solution`" instead.

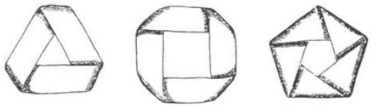
Sample Input and Output

Standard Input	Standard Output
5 3 3 2 4 1 5 4 1 5 2 3 2 4 5 1 3 5 2 5 4 3 2 1 1 2 3 4 5 4 3 1 4 2 3 4 2 3 1 3 1 2 4 0 0	2 4 1 5 3 1 2 3 4 5 No solution

Problem E : Möbius Strip

A Möbius strip is obtained by taking a long strip of paper, twisting the paper through 180 degrees (or in other words, a half-twist) and then, joining one end back to the other end of the strip. A möbius strip is shown in the figure to the right.

Instead of performing only one half-twist, we can also do zero, two, three, four, or more half-twists, and then tape the two ends. The resulting shape for three, four, and five half-twists respectively looks like below:



The "*type*" of each strip is a non-negative integer denoting the number of its half-twists. Now given a strip, consider a line along the length of the strip that lies one-third of the width away from one edge of the strip. Next, cut the strip along that line using scissors as shown in the figure to the right. The cutting is continued until it reaches its starting point.

After we cut the strip as above, we get a number of strips each with some number of half-twists. For example, if we begin with a strip of type 2, we get two strips of type 2. We are allowed to cut again and again some of the resulting strips if we wish. Some of the resulting strips may be intertwined. In that case, we consider them as two distinct strips and can cut each of the strips independently and separately from the other strip(s).

Now here is the question: Given two sets of strips, can we cut some strips in the two sets such that the two sets of strips are transformed into two new sets of strips with equal number of strips of each type?

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains two space-separated integers a and b ($1 \leqslant a, b \leqslant 100$), as the number of strips in each of the two sets of strips. The following two lines contain a and b non-negative integers respectively, as the types of strips in each set. All the given strip types are at most 100. The input terminates with a line containing `-1 -1` which should not be processed.

Output (Standard Output)

For each test case, on a separate line, write either the character "`Y`" denoting that we can make the required transformation or the character "`N`" denoting otherwise.

Sample Input and Output

Standard Input	Standard Output
1 2 0 0 0 4 4 1 1 2 4 1 2 4 4 2 4 3 4 8 4 4 3 -1 -1	Y N Y

Problem F : Expression

Due to heavy snow, George Dantzig was late for his class. When he arrived, his elementary school teacher, Jerzy Neyman had written a homework assignment on the blackboard. It seemed a little harder than usual, but George wrote it down anyway. The assignment was a complex mixture of additions, multiplications and divisions (shown by fractions) on positive numbers; something like the expression below:

$$5+\frac{4\times\frac{5}{\frac{7}{6}}}{2+3\times 5}\times 2+1+\frac{1}{1}$$

Every expression or sub-expression has a baseline on which all its elements lie, including operators, numbers, and fraction lines. Obviously, the numerator and denominator of a fraction are respectively placed on top and bottom of its fraction line and they themselves are smaller (possibly complex) sub-expressions. Note that multiplication has a higher priority than addition in evaluating mathematical expressions. Your task is to help George to evaluate the expression as a simple fraction.

Input (Standard Input)

There are several test cases in the input. Each test case starts with a line containing a single integer n as the height of the complex expression ($1 \leqslant n \leqslant 60$). The expression is presented in the next n lines. Each of these lines has at most 200 characters and consists of space characters, consecutive digits as positive numbers, "`*`" characters as operators for multiplication, "`+`" characters as operators for addition, and consecutive sequences of "`-`" characters as fraction lines. If a fraction line is made of t characters ($t \geqslant 3$), its corresponding numerator and denominator are horizontally aligned within its $t-2$ middle characters. Note that there might be some vertical space between a fraction line and its corresponding numerator and/or denominator. Also, the elements of a baseline might be separated by some space characters. Furthermore, some unnecessary spaces at the end of each line may be omitted. The input terminates with a line containing `0` which should not be processed.

Output (Standard Output)

For each test case, print a single line containing the value of the expression in the form of "numerator/denominator". Note that the numerator and the denominator of each fraction must be coprime, i.e., their greatest common divisor should be 1.

Sample Input and Output

Standard Input	Standard Output

7
  5
 --- 	
  7 1
4*-----
  6
5+---------*2+1+ -----
  2+3 *5 1
0
	2519/357

Problem G : Elections

Jenabkhan who has become billionaire from his Laboo bussiness, is now running for president. His country uses a strange mechanism, so-called electoral college, to select the president. There are several states in the country, and each state counts the votes independently. Depending on the population, each state has some members in the electoral college, and all of those members will vote the candidate with the majority of votes in their state. In the case of ties, each state has some tie-break rule to announce the clear winner. The president will be the candidate who receives more than half of votes in the electoral college.

Given the chance of Jenabkhan to win in each state, compute his winning probability in the electoral college.

Input (Standard Input)

The input consists of several test cases. Each test case starts with a line containing a single integer n denoting the number of states ($1 \leqslant n \leqslant 1000$). Each of the next n lines contains a real value p_i with at most 4 digits after the decimal point ($0 \leqslant p_i \leqslant 1$) and a positive integer e_i, specifying the winning probability of Jenabkhan in the i-th state and the number of electoral votes associated with that state, respectively. The total number of members in the electoral college is an odd number and is no more than 2000. The input terminates with a line containing 0 which should not be processed.

Output (Standard Output)

For each test case, output in a single line containing the winning probability of Jenabkhan, rounded to exactly four digits after the decimal point (e.g., 0.3000 is correct while 0.3 is not).

Sample Input and Output

Standard Input	Standard Output
1 0.4 1 3 0.5 1 0.5 2 0.5 10 3 0.5 1 0.5 2 0.5 2 2 0.2 1 0.8 10 2 0.25 1 0.751 10 0	0.4000 0.5000 0.5000 0.8000 0.7510

Problem H : Explosion at Cafebazaar

You are an engineer at *Cafebazaar* and your specialty is understanding networks and their behaviors. Your colleagues have designed a network of n switches with m directed links that connect pairs of these switches. Each switch has a buffer where it stores the data and two modes, called *sending mode* and *receiving mode*. In the sending mode, a switch sends the data stored in its buffer to each of its outgoing links simultaneously and at the end clears its buffer. In the receiving mode, a switch concatenates the data from all its incoming links and stores them in its buffer, so at the end, the length of the data stored in its buffer is equal to the sum of the lengths of all the data on the incoming links.

Assume that at time $t = 0$, all the switches are in sending mode and have an empty buffer except switch i which stores a 1-bit package of data in its buffer. Also, all the switches change their modes after each second, so at time $t = 1$ all the switches change to receiving mode, at time $t = 2$ they change to sending mode, and so on. Switch i is called *explosive* if the maximum length of data stored in the buffers of switches is not bounded as t goes to infinity.

Your task is to calculate the number of explosive switches in the network.

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains two space-separated integers n and m, where n indicates the number of switches and m indicates the number of directed links ($1 \leqslant n, m \leqslant 50,000$). Each of the next m lines contains two space-separated integers u, v where (u, v) indicates a directed link from switch u to switch v ($1 \leqslant u, v \leqslant n$, $u \neq v$). The input terminates with a line containing `0 0` which should not be processed.

Output (Standard Output)

For each test case, output a single line containing the number of explosive switches.

Sample Input and Output

Standard Input	Standard Output
3 3 1 2 2 3 3 1 5 6 1 2 2 3 3 1 3 4 4 5 5 3 4 5 1 2 2 3 3 2 3 2 3 4 0 0	0 5 3

Problem I : Linear Galaxy

The government of the "Linear" galaxy plans to redesign the public-transportation system in the galaxy. The Linear galaxy, which is very far away from our galaxy Milky Way, consists of $2^n + 1$ stars located on a single line. The i-th star in the galaxy is placed at position x_i on the line assuming the origin of the line is the starting point of the galaxy. Thus, the distance between stars i and j equals $|x_i - x_j|$.

There are two types of transportation systems in the Linear galaxy, namely TRT and SRT.

Teleport Rapid Transit (TRT) is an advanced transportation system, by which one can be instantly teleported from one star to another one within the TRT network. However, due to limited equipment, TRT stations can be installed in only $2^{n-1} + 1$ stars.

In order to make the whole transportation network connected, one of the stars in the TRT network and all stars not being in TRT network (a total of $2^{n-1} + 1$ stars) must be connected via the traditional Spacecraft Rapid Transit (SRT) system. A standard SRT network over m stars is a cycle of length m passing through each star exactly once. Interestingly, spacecrafts work more efficiently on longer flights. Therefore, the *efficiency* of an SRT network is defined as the minimum of its flight distances (i.e. distances between every two consecutive stars in the cycle).

Now, the government of the linear galaxy looks for an SRT network with the maximum efficiency constructed over $2^{n-1}+1$ of the stars.

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains a single integer n, where $2^n + 1$ is the number of stars in the Linear galaxy ($1 \leqslant n \leqslant 10$). The next line contains $2^n + 1$ distinct positive integers not exceeding 10^9 denoting the position of stars. The input terminates with a line containing `0` which should not be processed.

Output (Standard Output)

For each test case, output a line containing a single integer, the maximum efficiency among all possible SRT/TRT networks.

Sample Input and Output

Standard Input	Standard Output
1 1 2 3 2 11 10 30 12 20 0	2 10

Problem J : Rahyab

After finishing his studies, SpongeBob founded a company called *Rahyab-Tech*. Rahyab-Tech developed a mobile app called Rahyab, which helps drivers choose their path through inter-city roads. After a while, Rahyab became so popular that all drivers started using it during their trips.

SpongeBob discovered that one of the hardest problems he needs to solve is finding appropriate *routes* for drivers who want to go from Motel-Ghu to Tehran on Fridays. Every route starts with Motel-Ghu, and ends in Tehran after passing through some intermediate cities using the *roads*. Every road is a one-directional way from one city to another city. Roads do not have capacities. However, when more cars pass through a road, the road gets damaged faster. To avoid this, the government has the policy of charging every car by the most crowded road it has passed during its trip. The government's surveillance system counts the number of cars passing through each road, and at the end of the day, each car is charged based on the roads it has passed. A car that passes through roads $r_1, \ldots, r_k$, is charged $\max\{t_{r_1}^2, \ldots, t_{r_k}^2\}$, where t_{r_i} is the number of cars passing through r_i during that day.

Rahyab's suggested routes (from Motel-Ghu to Tehran) for different drivers are not necessarily the same. All drivers follow their suggested routes, but if any driver discovers somehow that (s)he could be charged less by using a route other than Rahyab's suggestion, Rahyab loses its customer loyalty, something intolerable for SpongeBob. Thus, the route suggested to each driver should be one of the best possible routes for that driver.

SpongeBob has developed an intelligent program that at the start of a day, predicts the exact number of cars C that travel from Motel-Ghu to Tehran on that day. Now, he has hired you to improve Rahyab in a way that given the map of roads and the number C, its suggested routes to drivers are such that no driver could benefit from changing his/her route.

Input (Standard Input)

There are multiple test cases in the input. Each test case starts with a line containing five space-separated numbers N, E, M, T, and C. Integers N and E are respectively the number of cities and roads in the map ($2 \leqslant N \leqslant 500$, $0 \leqslant E \leqslant 100000$). The cities are numbered 1 through N. Integers M and T are the number of Motel-Ghu and Tehran respectively ($1 \leqslant M, T \leqslant N$, $M \neq T$). Integer C is the number of trips from Motel-Ghu to Tehran on Friday ($0 \leqslant C \leqslant 10^6$). Each of the next E lines contains two space-separated integers x_i and y_i ($1 \leqslant x_i, y_i \leqslant N$) denoting a one-directional road from city x_i to city y_i. It is guaranteed that there is at least one route from Motel-Ghu to Tehran. The input terminates with a line containing `0 0 0 0 0` which should not be processed.

Output (Standard Output)

For each test case, print the total amount that all cars are charged if Rahyab's routing plans meet the conditions mentioned above and are followed by all drivers. It is known that the total amount is unique.

Sample Input and Output

Standard Input	Standard Output
3 3 1 3 7 1 3 1 2 2 3 4 5 2 3 6 1 2 1 3 2 4 4 3 2 3 0 0 0 0 0	91 54

Problem K : Base Stations

The Viracell Telecommunication is the largest mobile network operator in Nevercity. To better serve its customers, the operator has mounted a large number of Base Transceiver Stations (BTSs) throughout the city. Each BTS operates in one of the fixed predefined frequencies.

Due to rapid expansion of the network over the past few years, the quality of the service has been downgraded, causing many complaints from the customers. As a result, the national regulatory has decided to investigate the issue and prepare an official report. To this end, the regulatory has asked the operator to mount two special receivers provided by the regulatory on two BTSs in order to collect signaling data from all BTSs for further investigation. The operator is free to choose on which BTSs to mount the two receivers. Being short in time, the operator has hired you to consult them where to mount the receivers to achieve the best results.

According to your findings, the best results can be only achieved when the two receivers have minimum signal interference. You have also found two simple rules for reducing the signal interference. The first rule is that the receivers must be mounted on two BTSs with different frequencies. The second rule is that the receivers must be placed as far as possible. Therefore, your recommendation to the operator is to mount the receivers on the farthest pair of BTSs with different frequencies. The operator is now asking you to find such a pair.

Input (Standard Input)

There are multiple test cases in the input. The first line of each test case contains a positive integer n indicating the number of BTSs in the test case ($2 \leqslant n \leqslant 100,000$). The next n lines, each contains three integers x, y, and k, where (x, y) indicates the location of a BTS, and k indicates its frequency number ($0 \leqslant x, y \leqslant 10,000$, $0 \leqslant k < 100$). Each frequency number refers to one of the 100 predefined different frequencies in the network. It is assumed that there are at least two BTSs with different frequencies in each test case. Note that different BTSs may have the same location. The input terminates with a line containing 0 which should not be processed.

Output (Standard Output)

For each test case, output a line containing the square of the distance of the farthest pair of BTSs with different frequencies.

Sample Input and Output

Standard Input	Standard Output
4 0 0 0 10 0 0 5 10 0 5 5 1 8 5 20 0 5 30 1 50 5 0 20 25 1 25 35 0 30 40 1 25 10 1 50 30 1 0	50 2650

Problem L : Skeletons

You have recently started your clan in the game of Trash of Clans. Each clan has several villages, and some one-directional roads each connecting two (not necessarily different) villages. Assume that all the roads have the same length. You can produce troops in your clan, and then attack another clan. Your favourite troops are *wall breakers* – the skeletons that carry bombs, run and break walls of the enemy villages. The skeletons, like other troops in Trash of Clans, are smart and unpredictable.

During an attack you select the enemy clan, put one skeleton in every village of the enemy, choose a real positive value t for the bomb timers, and press the **Attack** key. Immediately, every skeleton randomly selects an arbitrary enemy village as the target such that each enemy village is the target of exactly one skeleton. Note that the starting and target village of a skeleton may be identical. All skeletons run at a constant and equal speed during the attack, without stop. They pass the roads in the correct direction and might pass a road several times. After exactly t seconds, a big bang happens and all skeletons explode.

An attack is successful if all skeletons can blow up their targets. The skeletons are so smart and each of them will choose a route to guarantee it will be at the target village exactly after t seconds, if such a route exists. Given a list of clans, your task is to determine the clans for which you can choose a timer value in order to guarantee the success of the attack.

Input (Standard Input)

There are multiple clan descriptions in the input. For each clan, the first line contains the number of villages n ($1 \leqslant n \leqslant 50,000$) and the number of roads m ($1 \leqslant m \leqslant 100,000$). The villages are numbered 1 through n. Each of the next m lines consists of two space-separated integers x and y denoting a one-directional road from village x to village y. There might be multiple roads connecting two villages, or some roads with identical start and end villages. The input terminates with a line containing `0 0` which should not be processed.

Output (Standard Output)

For each clan write either the character "Y" denoting that you can choose a timer value t guaranteeing the success of every attack, or "N" otherwise.

Sample Input and Output

Standard Input	Standard Output
9 10 1 2 2 3 3 4 4 5 5 1 4 6 6 7 7 8 8 9 9 3 3 3 1 2 2 3 1 3 0 0	Y N