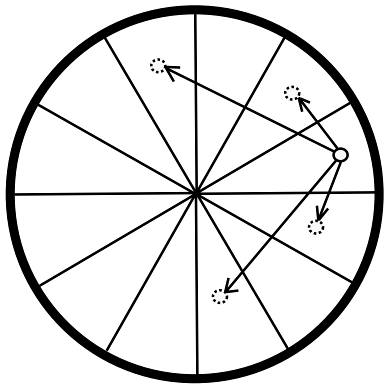
Problem A. Expert Flea

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

A flea has jumped onto a round table used in the popular quiz "What? Where? When?" In this quiz, the questions are put inside envelopes lying on the sectors of the round table. A panel of experts has to answer questions chosen by a roulette pointer from those lying on the table. The flea wants to read all the questions in advance and thus have more time to find the answers.



The round table is divided into n sectors numbered clockwise from 1 to n. The flea has jumped onto the first sector. From this sector it can either run to an adjacent sector or jump across two sectors (for example, if the table is divided into 12 sectors, then in one move the flea can get to sectors 2, 4, 10, and 12). The flea wants to visit each sector exactly once and return to the first sector, from which it will jump down to the floor and run away to think about the questions. Find the number of ways in which the flea can complete its journey.

Input

The only input line contains the number n of the sectors of the round table ($6 \leqslant n \leqslant 10^9$).

Output

Output the number of ways to visit each of the sectors exactly once and return to the first sector modulo $10^9 + 9$.

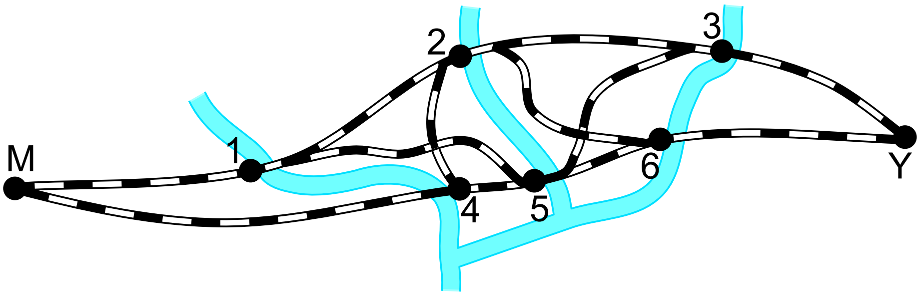
Example

input.txt	output.txt
6	12

Problem B. Transsib

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

The route of the Moscow–Vladivostok "Rossiya" passenger train is considered to be the main route of the Trans-Siberian Railway. Its itinerary includes Nizhny Novgorod, Kirov, Perm, and Yekaterinburg. The train goes from Moscow to Yekaterinburg in 25 h 41 min. The "Ural" train follows the southern line of the Trans-Siberian Railway through Kazan and completes the journey in 25 h 25 min. It is impossible to go by train from Moscow to Yekaterinburg in a shorter time.



This is the scheme of the railroads between Moscow (`M`) and Yekaterinburg (`Y`). It is seen that the routes of the trains "Rossiya" (the upper line in the scheme) and "Ural" (the lower line) are crossed by major rivers: Volga, Vyatka, and Kama. The former train crosses them at Nizhny Novgorod (1), Kotelnich (2), and Perm (3), respectively. The latter train crosses the rivers in 35 km west of Kazan (4), in Vyatskie Polyany (5), and in Sarapul (6). The scheme also shows direct lines connecting some of these cities.

In addition to passenger trains, there are also goods trains following these railroads. They can take one of the four routes:

1. Moscow – Nizhny Novgorod – Kotelnich – Sarapul – Yekaterinburg
2. Moscow – Kazan – Vyatskie Polyany – Sarapul – Yekaterinburg
3. Moscow – Kazan – Kotelnich – Perm – Yekaterinburg
4. Moscow – Nizhny Novgorod – Vyatskie Polyany – Perm – Yekaterinburg

Minister of Railway Transport wants to organize the goods train service in such a way that the freight flow from Moscow to Yekaterinburg be as much as possible. He knows that the bridges across the rivers shown in the scheme are the "bottlenecks" for the trains. For each bridge, the carrying capacity is known, i.e., the amount of freight that can be taken through the bridge in a day. Help the minister solve the problem.

Input

The only input line contains the carrying capacities of the bridges in Nizhny Novgorod, in Kotelnich, in Perm, near Kazan, in Vyatskie Polyany, and in Sarapul. These are integers in the range from 1 to 10^9.

Output

Find the daily amount of freight sent from Moscow along each of the routes specified above so that the total freight flow from Moscow to Yekaterinburg be maximal. Output these four numbers accurate to 10^{-3}, separating them with a space. If the problem has several solutions, output any of them.

Example

input.txt	output.txt
70 30 60 100 20 50	20.000 10.000 10.000 10.000

Problem C. Error 404

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	5 seconds
Memory limit:	64 MB

Experienced participants of the Ural Championship come to Yekaterinburg in advance to get accustomed to the severe weather conditions, walk around the city, and, of course, visit the "Limpopo" Water Park. Not many people know that there is Plant No. 404 near the water park, and this plant is called "Error 404" by the locals. The plant is not easy to find indeed, and it is still more difficult to learn what is happening there. Fortunately, one can watch the plant from a nearby pedestrian bridge. Because of the seeming stillness and desolation of the plant, one may think that it is out of operation, but this is not so. The main work area of the plant is the repair of aviation engines.

Some time ago the plant received an order to repair a broken gas turbine engine. It turned out that some blades were torn off, which resulted in an excess load on the engine shaft. Experts at the plant have decided that the engine could be repaired quickly by removing some of the intact blades so that the center of masses of the remaining blades would be on the rotation axis once again. To keep the engine power as large as possible, a minimum number of blades should be removed. At least one blade must be left, otherwise the engine would not work at all. The experts assert that when all the blades were intact their endpoints formed a regular n-gon. Tell them which blades should be removed.

Input

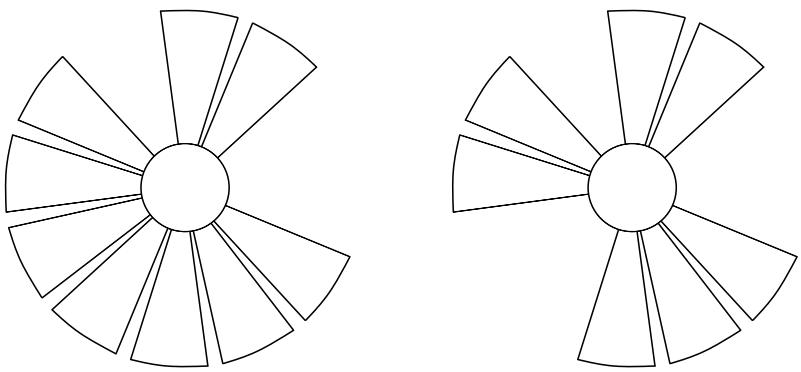
The first line contains the initial number of blades in the turbine n and the number of torn blades k ($3 \leqslant n \leqslant 20\,000$; $1 \leqslant k \leqslant n-1$). The integer n has at most two distinct prime divisors. The next line contains k integers, which are the numbers of the torn blades in ascending order. The blades are numbered from 1 to n clockwise.

Output

In the first line output the minimum number of blades that should be removed. In the second line output the numbers of these blades in any order separated with a space. If several answers are possible, output any of them. If it is impossible to repair the engine by removing some of the blades, output "`-1`".

Examples

input.txt	output.txt
12 3 3 4 12	2 8 9
3 1 1	-1



Problem D. Humpty Dumpty

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,
And the mome raths outgrabe.

Humpty Dumpty is an unpredictable creature. As soon as he helped Alice understand the poem about the Jabberwock, he ran away to chase borogoves. Alice met him at the d6 square, and since that time she has come to the eighth rank and become a queen, but Humpty Dumpty still hasn't been seen by anyone. As many as $100^{100^{100}}$ days passed since their talk (or, maybe, $100^{100^{100}}$ years — time flies very fast in the Looking-Glass world). Determine the probabilities of Humpty Dumpty being on the squares of the Looking-Glass world.

It is known that every second Humpty Dumpty moved from the square he was on to one of the adjacent squares (squares are adjacent if they share at least one vertex). The probability of Humpty Dumpty moving to a square is proportional to the number of borogoves on it.

Input

The input data are eight lines containing eight integers each. The integers are the numbers of borogoves on the squares of the Looking-Glass world. The first line describes the first rank (squares from a1 to h1) and the last line describes the last rank (squares from a8 to h8). There are at least one and at most 1 000 borogoves on each square of the Looking-Glass world.

Output

Output eight lines containing eight numbers each. The numbers should be the probabilities of finding Humpty Dumpty on the squares of the Looking-Glass world. The squares must be described in the order in which they are given in the input. The numbers must be accurate to at least 10^{-12}.

Example

input.txt
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
output.txt
0.007 0.012 0.012 0.012 0.012 0.012 0.012 0.007 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.012 0.019 0.019 0.019 0.019 0.019 0.019 0.012 0.007 0.012 0.012 0.012 0.012 0.012 0.012 0.007

The answer in the sample is incorrect, because the numbers in it are given with insufficient accuracy.

Problem E. The House of Doctor Dee

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

Mr. X is very fond of the novel *The House of Doctor Dee*, which is set in London in the 16th century and in the end of the 20th century. Rereading the novel once again, Mr. X decided to draw a map of London with routes of the protagonists Dr. Dee and Matthew Palmer. Dr. Dee, who lived in the 16th century, often traveled from his house to St. Paul's Cathedral, and Matthew, who lived in the 20th century, regularly walked from the National Gallery to the British Museum.

Every time it turned out that the protagonists were at the same point in London, Dr. Dee had visions about what was happening to Matthew at that moment. Such moments were often enough, and Mr. X decided to draw the motion trajectories of Dr. Dee and Matthew in such a way that their common part be as long as possible. However, Mr. X is not very good at the topography of London. He assumes that the city is built by a rectangular scheme — each street stretches through the whole city either from west to east or from north to south. The house of Dr. Dee, St. Paul's Cathedral, the National Gallery, and the British Museum are located exactly at the intersections of two orthogonal streets. Moreover, Mr. X is sure that Dr. Dee and Matthew always took one of the shortest possible routes.

Though London is very big, Mr. X has already drawn its map. He has also marked Dr. Dee's house, St. Paul's Cathedral, the National Gallery, and the British Museum on the map. It now remains to draw the required routes.

Input

The first line contains coordinates of Dr. Dee's house separated with a space. The following lines contain the coordinates of St. Paul's Cathedral, the National Gallery, and the British Museum in the same format. All the coordinates are integers with absolute values not exceeding 10^9.

Output

Output the maximum length of the path that Dr. Dee and Matthew Palmer's routes can have in common.

Example

input.txt	output.txt
2 2 4 4 5 5 3 3	2

Problem F. Circular Strings

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

A growing number of people accept nowadays the theory of strings and superstrings and of the mirror world. One of the most interesting objects of study within this theory is circular strings. They can be used for traveling between worlds: flying through the ring of such a string, an observer finds himself in the mirror world, which can have entirely different stars, galaxies, and, possibly, life. The traveler can return to his world by flying backward through the same or any other circular string. Unfortunately, superstrings are unstable. Gradually losing their energy, they contract and eventually explode when their diameter decreases to the diameter of an elementary particle. Which means that a travel to the mirror world is potentially dangerous.

Circular strings also have a practical application. They can be used to draw any regular polygon without ruler or compasses. For this, a string should be made to oscillate exactly in a plane at one of its resonance frequencies. In this situation, several points of the string stay fixed. According to the theory, these points are vertices of the required polygon. Physicists have just made such an experiment and now ask you to analyze the results.

You are given n pairs of real numbers. The physicists claim that these are the coordinates of vertices of a nondegenerate n-gon written in the traversal order.

Input

The first line contains the integer n ($3 \leqslant n \leqslant 100$). The i-th of the following n lines contains real numbers x_i and y_i separated with a space ($0 \leqslant x_i, y_i \leqslant 1$); these numbers are the coordinates of the i-th point. The coordinates of different points may coincide, but it is guaranteed that there exists at least one pair of points at a distance of at least 0.3. The coordinates are given with accuracy of at least 10^{-10}.

Output

If the experiment didn't produce vertices of a regular n-gon in the traversal order, output "`NO`". Otherwise, output "`YES`". It is guaranteed that in the case of the negative answer the coordinates of the points can't be changed by less than 10^{-5} so that they become the coordinates of vertices of a regular n-gon written in the traversal order.

Examples

input.txt	output.txt
4 0 0 1 0 1 1 0 1	YES
3 0 0 1 0 0.5 1	NO

Problem G. Old Ural Legend

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	1 second
Memory limit:	64 MB

According to a tale, in the sacred Indian city of Benares, beneath a temple that marked the center of the world, Brahma put three diamond needles and placed 64 gold disks on them. Priests of the temple are busy transferring the disks from needle to needle. It is believed that the world will perish as soon as the task is done.

Another legend is known in Ural. It is said that a monastery is lost in woods at the boundary of Europe and Asia, where the mythical stone flower grew. The monks who live there are doomed to write positive integers on parchment until the Last Judgement. Nobody knows when and where they started this work. There is a legend among monks that when the monastery had been built its first abbot was visited in his dream by the Archangel Gabriel, who showed a stone on the slopes of the Ural mountains where a string of digits was carved. Gabriel ordered to write all the integers starting from the smallest integer that was not a substring of that string. If this legend is true, which integer was written by the monks first?

Input

The only input line contains the nonempty string consisting of decimal digits carved on the stone. The length of the string does not exceed 10^5.

Output

Output the positive integer that is the first number written by the monks.

Example

input.txt	output.txt
10123456789	11

Problem H. The Party of Ural Champions

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	64 MB

Because of the coming election to the Regional Duma, all the billboards along the roads in Yekaterinburg have been replaced. They are now agitating for the Party of Ural Champions. There are n intersections in Yekaterinburg, and some of them are connected by two-way roads. Any two intersections are connected by a sequence of such roads. There can be at most one billboard on any road connecting two intersections. Each billboard faces one side only, which means that the agitation can be seen by drivers moving in only one of the two directions.

The Party of Ural Champions has presented a report to the election committee, in which it has given information on the campaign materials. In particular, for each pair of intersections the report specifies the minimum number of times a car driver will see the agitation when driving from the first of these intersection to the second regardless of the route he would take.

Chairman of the Regional Election Committee suspects that there is an error in the report, because there is no configuration of roads and no arrangement of billboards corresponding to the given data. Your task is to verify this assertion.

Input

The first line contains the integer n ($2 \leqslant n \leqslant 300$). In each of the following n lines you are given n integers separated with a space. The number in the i-th line at the j-th position is equal to the minimum number of times a car driver will see the agitation when driving from the i-th intersection to the j-th intersection. All the integers in this table are in the range from 0 to $n - 1$. All the numbers on the main diagonal are zeros.

Output

If there is a configuration of roads and billboards that corresponds to the data in the report, then output "`YES`" in the first line. Then output n lines containing n symbols each. In the i-th line at the j-th position output

- "`0`" if the i-th and the j-th intersections are not connected by a road;
- "`1`" if the i-th and the j-th intersections are connected by a road but there is no billboard on this road or there is a billboard but a car driver will not see the agitation when driving from the i-th intersection to the j-th intersection;
- "`2`" if the i-th and the j-th intersections are connected by a road and a car driver will see the agitation when driving from the i-th intersection to the j-th intersection.

No intersection can be connected by a road with itself. If several answers are possible, output any of them.

If there is no required configuration of roads and billboards, output "`NO`" in the only line.

Examples

input.txt	output.txt
5 0 1 1 1 1 1 0 1 0 1 0 0 0 0 0 2 1 2 0 2 0 0 0 0 0	YES 00202 00210 11001 02000 10100
2 0 1 1 0	NO

Problem I. A Deputy's Morning

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	64 MB

There are exactly n bus stops and m bus routes in Yekaterinburg. The traffic system is designed so that the distance between two adjacent stops is covered by any bus in exactly one minute. Each bus starts its journey no earlier than 7 am at an integer number of minutes and lets the passengers in at the first stop of its route. No two buses can go on the same route simultaneously. When a bus reaches the last stop of its route, it does not turn round and go back. There is no bus schedule in Yekaterinburg, and buses can go arbitrarily allowing for the above constraints.

Deputy of the City Duma Leonid decided to set up a social control of the public transportation system. At 06:50 he came out to the bus stop nearest to his home with a notebook. He spoke to the people who were waiting there and they explained him the way they usually used buses. Everybody who wants to get into a bus comes to a bus stop in advance, no later than at 06:59. Boarding and debussing take no time at all because people are in a hurry. Each passenger chooses a bus by the following algorithm.

- If a bus that will take the passenger to the required bus stop arrives to the stop, the passenger takes this bus.
- If several suitable buses come to the bus stop simultaneously, then the passenger takes the bus that will take them to the required stop earlier.
- If there are several such buses, then the passenger takes the bus with the minimal route number.

At exactly 7 am Leonid started writing the route numbers of the passing buses and the times at which they arrived to the stop. The crowd at the stop was gradually diminishing. Leonid was starting to enjoy the process when he suddenly remembered that he had to attend a session of the Collegiate Programming Committee. Then he got into the bus that came to the bus stop. There were 42 people in the bus and 13 people entered the bus in addition to Leonid. Help him determine the minimum and maximum number of those people that would be in the bus when it arrived to the stop where Leonid had to get off.

Input

The first line contains the integers n and m separated with a space ($3 \le n, m \le 100$). The i-th of the following m lines describes the route with number i. The description is a sequence of pairwise distinct numbers from 1 to n, which are the numbers of stops on the route. Each route contains at least two stops. The list ends with the number -1. The numbers in the list are separated with a space. Leonid lives near the stop with number 1 and plans to get off at the stop with number 2.

In the next line you are given the number of buses k that Leonid recorded in his notebook ($1 \le k \le 100$). Each of the following k lines contains the time when the bus arrived to the stop in the format `hh:mm` ($07 \le hh \le 23$; $00 \le mm \le 59$) and, after a space, the route number of this bus. The records in the notebook are time-ordered. The last in the list is the bus that Leonid took. It is known that the notebook also contains information on all the buses that arrived to the stop simultaneously with the last bus. It is guaranteed that the bus Leonid took has stop 2 in its route and that stop 1 is not the first stop of this route.

Output

Output two integers separated with a space. These should be the maximum and minimum numbers of people going with Leonid the whole way from stop 1 to stop 2.

Example

input.txt	output.txt
4 3 1 4 -1 4 1 -1 3 1 4 2 -1 2 07:00 1 07:10 3	13 55

Problem J. Ski-Trails for Robots

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	64 MB

One of the stages of the Robot Cross-Country World Cup was held at the Uktus Ski Lodge in Yekaterinburg.

Professor Popov's laboratory sent its newest Robot NS6 to take part in the race. The neural networks of this robot were well-trained in the classic style skiing. The robot was not very lucky with the drawing: he was one of the last racers to start and the trails had been already heaped up with the participants who hadn't been able to make their way to the finish. This created a serious problem, as the robot now had to keep switching between the ski trails in order to skirt the obstacles. As a result, it lost the precious time because moving to an adjacent trail each time took one second.

Given the places where the fallen robots lie, determine the optimal way to skirt them all in the minimum time.

Input

The first line contains integers n, s, and k separated with a space ($2 \leqslant n \leqslant 10^5$; $1 \leqslant s \leqslant n$; $0 \leqslant k \leqslant 10^5$). There are n parallel ski trails that lead from start to finish. They are numbered successively from 1 to n. Robot NS6 starts along the trail with number s. The integer k is the number of robots which fell down on the trails.

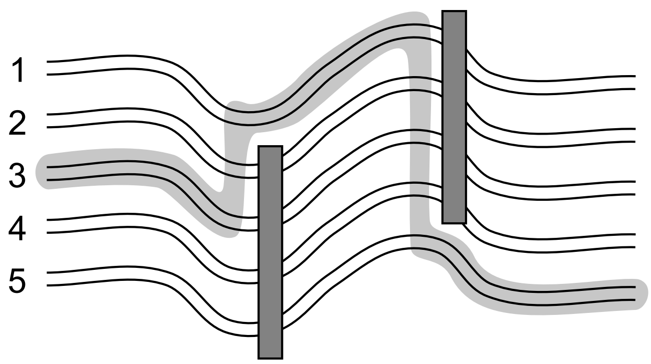
The following k lines describe the lying robots in the order from start to finish. In each line there are integers l and r, which mean that a robot blocked the trails with numbers from l to r inclusive ($1 \leqslant l \leqslant r \leqslant n$). You can assume that all the fallen robots lie at a sufficient distance from each other (and from the start) so that Robot NS6 can perform the necessary maneuvers. If some robot blocks an outermost trail, it can be skirted on one side only. No robot blocks all the trails simultaneously.

Output

Output the minimum time in seconds that Robot NS6 spent for switching from trail to trail in order to skirt all the fallen contestants and successfully complete the race.

Example

input.txt	output.txt
5 3 2 2 5 1 4	6



Problem K. Metro to Every Home

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	64 MB

Artem is a fan of Yekaterinburg Metro. He is now renovating his room. According to his design, one of the walls of the room will be covered with white wallpaper and a green straight line will stretch across the wall from left to right. This line will remind him of the only metro line in Yekaterinburg.

Artem has prepared n wallpaper strips and drawn a green line on each strip from its left edge to its right edge. In which order should he put these strips onto the wall so that the green lines form one segment of a straight line stretching from the left edge of the wall to its right edge?

For each strip the distance from its lower edge to the left and right endpoints of the segment drawn on it is known. All the strips are of the same width and their height is equal to the height of the wall. The strips may be turned upside down before being pasted to the wall.

Input

The first line contains integers h and n ($1 \leqslant h \leqslant 100\,000$; $1 \leqslant n \leqslant 50\,000$), which are the height of Artem's room and the number of prepared wallpaper strips. The i-th of the following n lines contains integers l and r ($0 \leqslant l, r \leqslant h$), which are the distances from the lower edge of the strip to the left and right endpoints of the green segment drawn on it.

Output

Output n integers separated with a space. These should be numbers of the strips as they should be pasted to the wall from left to right. If a strip should be turned upside down before pasting, then its number should be preceded with a minus. The strips are numbered from 1 to n as they are given in the input. If there are several possible answers, output any of them. If it is impossible to put the wallpaper as required, output "0".

Examples

input.txt	output.txt
5 3 3 2 2 1 2 1	-3 1 2
5 3 3 2 2 1 3 2	0