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ACM International Collegiate Programming Contest 2010

Latin American Regional Contests

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Contest Session

This problem set contains 11 problems; pages are numbered from 1 to 15.

This problem set is used in simultaneous contests hosted in the following countries:

- Argentina
- Bolivia
- Brazil
- Chile
- Colombia
- Cuba
- Peru
- Mexico
- Venezuela

General Information

Unless otherwise stated, the following conditions hold for all problems.

Input

1. The input must be read from standard input.
2. The input contains several test cases. Each test case is described using a number of lines that depends on the problem.
3. When a line of data contains several values, they are separated by *single* spaces. No other spaces appear in the input. There are no empty lines.
4. Every line, including the last one, has the usual end-of-line mark.
5. The end of input is indicated with a line containing certain values that depend on the problem. This line should not be processed as a test case.

Output

1. The output must be written to standard output.
2. The result of each test case must appear in the output using a number of lines that depends on the problem.
3. When a line of results contains several values, they must be separated by *single* spaces. No other spaces should appear in the output. There should be no empty lines.
4. Every line, including the last one, must have the usual end-of-line mark.
5. No special mark should be written to indicate the end of output.

Problem A
Ants Colony

Problem code name: `ants`

A group of ants is really proud because they built a magnificent and large colony. However, the enormous size has become a problem, because many ants do not know the path between some parts of the colony. They desperately need your help!

The colony of ants was made as a series of N anthills, connected by tunnels. The ants, obsessive as they are, numbered the anthills sequentially as they built them. The first anthill, numbered 0, did not require any tunnel, but for each of the subsequent anthills, 1 through $N-1$, the ants also built a single tunnel that connected the new anthill to one of the existing anthills. Of course, this tunnel was enough to allow any ant to go to any previously built anthill, possibly passing through other anthills in its path, so they did not bother making extra tunnels and continued building more anthills.

Your job is, given the structure of the colony and a set of queries, calculate for each query the shortest path between pairs of anthills. The length of a path is the sum of the lengths of all tunnels that need to be traveled.

Input

Each test case is given using several lines. The first line contains an integer N representing the number of anthills in the colony ($2 \leq N \leq 10^5$). Each of the next $N-1$ lines contains two integers that describe a tunnel. Line i, for $1 \leq i \leq N-1$, contains A_i and L_i, indicating that anthill i was connected directly to anthill A_i with a tunnel of length L_i ($0 \leq A_i \leq i-1$ and $1 \leq L_i \leq 10^9$). The next line contains an integer Q representing the number of queries that follow ($1 \leq Q \leq 10^5$). Each of the next Q lines describes a query and contains two distinct integers S and T ($0 \leq S, T \leq N-1$), representing respectively the source and target anthills.

The last test case is followed by a line containing one zero.

Output

For each test case output a single line with Q integers, each of them being the length of a shortest path between the pair of anthills of a query. Write the results for each query in the same order that the queries were given in the input.

Sample input	**Output for the sample input**
6 0 8 1 7 1 9 0 3 4 2 4 2 3 5 2 1 4 0 3 2 0 1 2 1 0 0 1 6 0 1000000000 1 1000000000 2 1000000000 3 1000000000 4 1000000000 1 5 0 0	16 20 11 17 1 1 5000000000

Problem B
Bingo!

Problem code name: `bingo`

Albert, Charles and Mary invented a new version of the classical game Bingo. In traditional Bingo the game is presided over by a non-player known as the caller. At the beginning of the game each player is given a card containing a unique combination of numbers from 0 to N arranged in columns and rows. The caller has a bag containing $N + 1$ balls, numbered from 0 to N. On each turn, the caller randomly selects a ball from the bag, announces the number of the drawn ball to the players, and sets the ball aside so that it cannot be selected again. Each player searches his card for the called number and marks it if he finds it. The first player who marks a complete pre-announced pattern on the card (for example, a full horizontal line) wins a prize.

In the **A**lbert-**C**harles-**M**ary version, on each turn, the caller draws a first ball, returns it to the bag, draws a second ball, returns it to the bag, and then calls out the absolute difference between the two ball numbers. To generate even more excitement, before the game started a possibly empty subset of balls is removed from the bag, in such a way that at least two balls remain there. They would like to know if every number from 0 to N may still be called out with the new drawing method considering the balls that were left in the bag.

Input

Each test case is given using exactly two lines. The first line contains two integers N and B. The meaning of N was described above ($1 \leq N \leq 90$), while B represents the number of balls which remained in the bag ($2 \leq B \leq N + 1$). The second line contains B distinct integers b_i, indicating the balls which remained in the bag ($0 \leq b_i \leq N$).

The last test case is followed by a line containing two zeros.

Output

For each test case output a single line containing a single uppercase '`Y`' if is possible to call out every number from 0 to N, inclusive, or a single uppercase '`N`' otherwise.

Sample input	**Output for the sample input**

`6 7`
`2 1 3 4 0 6 5`
`5 4`
`5 3 0 1`
`5 3`
`1 5 0`
`0 0`
	`Y`
	`Y`
	`N`

Problem C
Cocircular Points

Problem code name: `cocircular`

You probably know what a set of collinear points is: a set of points such that there exists a straight line that passes through all of them. A set of cocircular points is defined in the same fashion, but instead of a straight line, we ask that there is a circle such that every point of the set lies over its perimeter.

The International Collinear Points Centre (ICPC) has assigned you the following task: given a set of points, calculate the size of the larger subset of cocircular points.

Input

Each test case is given using several lines. The first line contains an integer N representing the number of points in the set ($1 \leq N \leq 100$). Each of the next N lines contains two integers X and Y representing the coordinates of a point of the set ($-10^4 \leq X, Y \leq 10^4$). Within each test case, no two points have the same location.

The last test case is followed by a line containing one zero.

Output

For each test case output a single line with a single integer representing the number of points in one of the largest subsets of the input that are cocircular.

Sample input	**Output for the sample input**
7 -10 0 0 -10 10 0 0 10 -20 10 -10 20 -2 4 4 -10000 10000 10000 10000 10000 -10000 -10000 -9999 3 -1 0 0 0 1 0 0	5 3 2

Problem D
Digits Count

Problem code name: `digits`

Diana is going to write a list of all positive integers between A and B, inclusive, in base 10 and without any leading zeros. She wants to know how many times each digit is going to be used.

Input

Each test case is given in a single line that contains two integers A and B ($1 \leq A \leq B \leq 10^8$).

The last test case is followed by a line containing two zeros.

Output

For each test case output a single line with 10 integers representing the number of times each digit is used when writing all integers between A and B, inclusive, in base 10 and without leading zeros. Write the counter for each digit in increasing order from 0 to 9.

Sample input	**Output for the sample input**

`1 9`
`12 321`
`5987 6123`
`12345678 12345679`
`0 0`
	`0 1 1 1 1 1 1 1 1 1`
	`61 169 163 83 61 61 61 61 61 61`
	`134 58 28 24 23 36 147 24 27 47`
	`0 2 2 2 2 2 2 2 1 1`

Problem E
Electric Needs

Problem code name: `electric`

You are going to construct a new factory in your city. Since you have major electric needs, having the factory placed close to a power plant is important. You want to build a prioritized list of possible locations.

The area in which the factory needs to be located can be represented as a rectangular grid of N rows and M columns of cells. Some of those cells contain a power plant. The new factory occupies exactly one cell, and can be placed in any empty cell (i.e., any cell that does not contain a power plant).

Numbering rows from 1 to N and columns from 1 to M, the location of a cell can be described by two integers. Cell (i, j) is the cell in row i and column j. The distance between cell (i_0, j_0) and cell (i_1, j_1) is $\max(|i_0 - i_1|, |j_0 - j_1|)$ where $|x|$ represents the absolute value of x. The electric priority of a location is its minimum distance to a power plant.

With this in mind, you will number all possible locations with consecutive integers starting from 1. You will do it in ascending order of electric priority. Among locations with the same electric priority, you will number them in ascending order of their row numbers. Among locations with the same electric priority and row number, you will list them in ascending order of column numbers.

In the following picture you can see a 4×7 grid. Black cells are the cells in which there is a power plant. Dark gray cells have an electric priority of 1, light gray cells an electric priority of 2 and white cells an electric priority of 3. The number inside each cell is the number assigned by you to the location.

22	23	12	1	2	3	13
24	14	15	4		5	16
25	17	6	7	8	9	18
26	19	10		11	20	21

You will receive several queries about the prioritized list built. In each query you will be given a number representing a position in the prioritized list and you have to calculate which location was assigned the given position.

Input

Each test case is given using several lines. The first line contains three integers N, M and P, representing the number of rows and columns of the grid ($1 \leq N, M \leq 10^9$) and the number of existing power plants ($1 \leq P \leq 20$). Each of the next P lines contains two integers R and C representing the row and column numbers of the location of a power plant ($1 \leq R \leq N$ and $1 \leq C \leq M$). Within each test case, all power plant locations are different. The next line contains a single integer Q representing the number of queries ($1 \leq Q \leq 50$). Then follows a line with Q integers $p_1, ..., p_Q$ representing positions in the prioritized list ($1 \leq p_i \leq N \times M - P$).

The last test case is followed by a line containing three zeros.

Output

For each test case output $Q + 1$ lines. Line i of the first Q lines must contain two integers representing the row and column numbers of the location that was assigned number p_i. The last line for each test case must contain a single character '-' (hyphen).

Sample input	**Output for the sample input**
4 7 2 2 5 4 4 6 1 6 11 16 21 26 1000000000 1000000000 1 1 1 1 999999999999999999 0 0 0	1 4 3 3 4 5 2 7 4 7 4 1 - 1000000000 1000000000 -

Problem F
Flowers Flourish from France

Problem code name: `flowers`

Fiona has always loved poetry, and recently she discovered a fascinating poetical form. *Tautograms* are a special case of alliteration, which is the occurrence of the same letter at the beginning of adjacent words. In particular, a sentence is a tautogram if all of its words start with the same letter.

For instance, the following sentences are tautograms:

- Flowers Flourish from France
- Sam Simmonds speaks softly
- Peter pIckEd pePPers
- truly tautograms triumph

Fiona wants to dazzle her boyfriend with a romantic letter full of this kind of sentences. Please help Fiona to check if each sentence she wrote down is a tautogram or not.

Input

Each test case is given in a single line that contains a sentence. A sentence consists of a sequence of at most 50 words separated by single spaces. A word is a sequence of at most 20 contiguous uppercase and lowercase letters from the English alphabet. A word contains at least one letter and a sentence contains at least one word.

The last test case is followed by a line containing only a single character '`*`' (asterisk).

Output

For each test case output a single line containing an uppercase '`Y`' if the sentence is a tautogram, or an uppercase '`N`' otherwise.

Sample input	**Output for the sample input**

`Flowers Flourish from France`
`Sam Simmonds speaks softly`
`Peter pIckEd pePPers`
`truly tautograms triumph`
`this is NOT a tautogram`
`*`
	`Y`
	`Y`
	`Y`
	`Y`
	`N`

Problem G
Growing Strings

Problem code name: `growing`

Gene and Gina have a particular kind of farm. Instead of growing animals and vegetables, as it is usually the case in regular farms, they grow strings. A string is a sequence of characters. Strings have the particularity that, as they grow, they add characters to the left and/or to the right of themselves, but they never lose characters, nor insert new characters in the middle.

Gene and Gina have a collection of photos of some strings at different times during their growth. The problem is that the collection is not annotated, so they forgot to which string each photo belongs to. They want to put together a wall to illustrate strings growing procedures, but they need your help to find an appropriate sequence of photos.

Each photo illustrates a string. The sequence of photos must be such that if s_i comes immediately before s_{i+1} in the sequence, then s_{i+1} is a string that may have grown from s_i (i.e., s_i appears as a consecutive substring of s_{i+1}). Also, they do not want to use repeated pictures, so all strings in the sequence must be different.

Given a set of strings representing all available photos, your job is to calculate the size of the largest sequence they can produce following the guidelines above.

Input

Each test case is given using several lines. The first line contains an integer N representing the number of strings in the set ($1 \leq N \leq 10^4$). Each of the following N lines contains a different non-empty string of at most 1000 lowercase letters of the English alphabet. Within each test case, the sum of the lengths of all strings is at most 10^6.

The last test case is followed by a line containing one zero.

Output

For each test case output a single line with a single integer representing the size of the largest sequence of photos that can be produced.

Sample input	**Output for the sample input**
6 plant ant cant decant deca an 2 supercalifragilisticexpialidocious rag 0	4 2

Problem H
Hyperactive Girl

Problem code name: `hyperactive`

Helen is a hyperactive girl. She wants to schedule her activities so that at any moment of the day there is at least one thing she can do. She does not care if her activities overlap in time, as long as every moment of her day has an activity scheduled.

Helen divided the day in a particular way. The day starts at time 0 and finishes at time M. Each moment of the day is represented by a real number between 0 and M, inclusive. Helen made a list of all possible activities, with their start and finish times. Now she must decide which subset of activities to schedule.

If an activity starts at time S and finishes at time F, then we say that it covers all moments between S and F, inclusive. Helen does not want to waste any activities, so she will only choose minimal subsets of activities that cover the day to be scheduled. A subset of activities is a minimal subset that covers the day if and only if:

1. every moment of the day is covered by at least one activity of the subset; and
2. removing any of the activities from the subset would leave at least one moment of the day uncovered.

Note that some moments of the day may be covered by more than one activity.

Given the list of possible activities for one day, you must help Helen by determining how many distinct minimal subsets cover the day.

Input

Each test case is given using several lines. The first line contains two integers M and N, representing respectively the highest value for a moment in the day ($1 \leq M \leq 10^9$) and the number of possible activities for the day ($1 \leq N \leq 100$). Each of the next N lines describes one possible activity and contains two integers S and F, representing respectively the start and finish times of the activity ($0 \leq S < F \leq M$).

The last test case is followed by a line containing two zeros.

Output

For each test case output a single line with a single integer representing the number of minimal subsets that cover the day. To make your life easier, print the remainder of dividing the solution by 10^8.

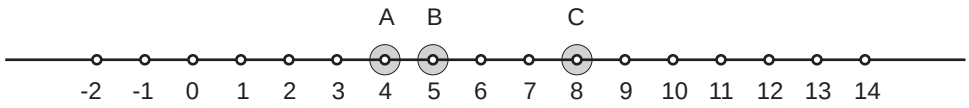
Sample input	**Output for the sample input**
8 7 0 3 2 5 5 8 1 3 3 6 4 6 0 2 1 1 0 1 2 1 0 1 0 0	4 1 0

Problem I
Ingenious Metro

Problem code name: `ingenious`

The King of Logonia will inaugurate soon a new and revolutionary metro, based on an invention of the Royal Engineers, which allows teletransportation.

The new metro consists of a very long tunnel with a station at each kilometer. There are also T teletransporters, which are located at some of the stations. In each station there is a keyboard with T keys, where each key corresponds to one teletransporter. The figure below illustrates a metro system with three teletransporters, located in stations marked A, B and C.



The metro works as follows. The user goes in a station (the *start* station) and presses the key corresponding to the teletransporter he wants to use. The user is then teletransported to the station which is at the same distance from the teletransporter as the start station, but on the opposite side relative to the teletransporter. More precisely, if the location of the start station is i and the user presses the key corresponding to the teletransporter located in position j, he will be taken to the station located at position $2 \times j - i$. For example, if the user is in station 6 and wants to go to station -2, he can use the teletransporter C (goes from 6 to 10) and then the teletransporter A (goes from 10 to -2).

The King, however, knows that it is possible that there is no sequence of teletransporters that will take the user from a given station X to a given station Y. To avoid that the users keep trying to go where they cannot go, he wants to make a program available in the Internet to help users. The King wants you to write a program which, given the position of each teletransporter, answers a series of queries. For each query the start and the destination stations are given, and your program must determine if it is possible for the user to go from start to destination.

Input

Each test case is given using several lines. The first line contains two integers T and Q indicating respectively the number of teletransporters ($1 \leq T \leq 10^5$) and the number of queries ($1 \leq Q \leq 10$). The second line contains T different integers t_i indicating the position of the teletransporters ($-10^7 \leq t_i \leq 10^7$). Each of the Q following lines describes a query and contains two distinct integers S and D indicating the position of the start and destination stations ($-10^7 \leq S, D \leq 10^7$).

The last test case is followed by a line containing two zeros.

Output

For each test case output a single line containing the answers to the Q queries, in the same order that the queries were given in the input. For each query you must output an uppercase

'Y' if it is possible to reach the destination station from the start station using the metro, or an uppercase 'N' otherwise.

Sample input	**Output for the sample input**
1 1 -2 -6 2 5 2 10 20 30 40 50 10 15 20 40 5 3 0 5 -3 -8 4 -1 499 4 237 -1 -591 0 0	Y N Y Y N Y

Problem J
Jollo

Problem code name: `jollo`

Jollo is a simple card game which the children from Logonia love to play. It is played between two players with a normal deck of 52 cards. In the game, cards are ordered according to their rank and suit, forming a sequence of 52 distinct values.

The game is composed of three rounds, played in a best-of-three series (a player must win two rounds to win the game). At the beginning of the game the deck is shuffled and each player is given a hand of three cards. In each round the players show one card to each other and the player with the highest card wins the round. The cards shown in a round are discarded (i.e., they cannot be shown again).

The King's son loves to play the game. But he is not very smart, losing frequently to his little sister. And when he loses, he cries so loud no one can stand it. The servant who deals the cards to the Prince and his sister is afraid he will be sent to prison if the Prince continues to lose. The servant is allowed to see every card he deals, and after dealing five cards (three to the Princess and two to the Prince) he wants to know which is the lowest card he should deal to the Prince so that there is no chance he will lose the game, no matter how badly he plays.

Input

Each test case is given in a single line that contains five distinct integers A, B, C, X and Y, describing the cards dealt to the players. The first three cards are given to the Princess ($1 \leq A, B, C \leq 52$) and the last two cards are given to the Prince ($1 \leq X, Y \leq 52$).

The last test case is followed by a line containing five zeros.

Output

For each test case output a single line. If there exists a card that will make the Prince win the game no matter how badly he plays, you must print the lowest such a card. Otherwise, print `-1`.

Sample input	**Output for the sample input**

`28 51 29 50 52`
`50 26 19 10 27`
`10 20 30 24 26`
`46 48 49 47 50`
`0 0 0 0 0`
	`30`
	`-1`
	`21`
	`51`

Problem K
Kids' Wishes

Problem code name: `kids`

Kevin is a kid. He has lunch at school together with many more kids. They use to go outdoors and have lunch sitting on the ground. They love to form a big circle in which each kid has exactly two neighbors, one on the left and one on the right. Sometimes the teacher has problems arranging the circle because some kids wish to sit down next to other kids. Each kid may wish to sit down next to at most two other kids, because each kid has just two neighbors in the circle. The teacher wants to know whether it is possible to arrange the circle in such a way that all kids' wishes are satisfied. You clean up the place when the lunch ends. Since you want to finish your work as early as possible, help the teacher in answering that question.

Input

Each test case is given using several lines. The first line contains two integers K and W representing respectively the number of kids ($3 \leq K \leq 10^9$) and the number of wishes ($0 \leq W \leq 10^5$). Kids are identified with numbers between 1 and K. Each of the next W lines describes a different wish using two distinct integers A and B ($1 \leq A, B \leq K$); these values represent that kid A wishes to sit down next to kid B. Each kid has at most two wishes.

The last test case is followed by a line containing two zeros.

Output

For each test case output a single line containing an uppercase '`Y`' if it is possible to arrange a circle in such a way that all kids' wishes are satisfied, or an uppercase '`N`' otherwise.

Sample input	**Output for the sample input**

`4 3`
`2 3`
`1 3`
`2 1`
`1000000000 0`
`3 6`
`3 2`
`2 1`
`1 2`
`1 3`
`2 3`
`3 1`
`0 0`
	`N`
	`Y`
	`Y`